Railway Mechanical Engineer

FOUNDED IN

A Bill That Must Be Paid

"FOR 1932 as a whole, new materials have not been supplied in amount adequate to restore more than half of the locomotive mileage which has actually been run out . . . not more than 80 per cent of the miles run out have been restored by maintenance—a fact which strongly points to the conclusion that for about one-third of the work actually done the necessary material could only have been secured by robbing power reported as stored serviceable or awaiting shops . . . Even with declining traffic, motive-power-department supervisors have had to do fast work to keep from paying the piper. With a steady increase in traffic, even though slight, the bill will have to be paid." An excerpt from an editorial in this issue entitled, "The Task Grows Harder."

January

Vol. 107 No. 1

Published monthly by Simmons-Boardman Publishing Company, 1309 Noble Street, Philadelphia, Pa. Entered as second class matter, March 10, 1928, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879. Application pending transfer as second class matter to Philadelphia, Pa., Post Office.

Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal
With which are also incorporated the National Car Builder, American Engineer and Railroad Journal, and Railway Master Mechanic. Name Registered, U. S. Patent Office

January, 1933

Volume 107 *No. 1*

Motive Power Department:

Car Department:

General:

Editorials:

The Reader's Page:

Car Foremen and Inspectors:

Back Shop and Enginehouse:

Published on the first Thursday of every month by the

Simmons-Boardman Publishing Company

1309 Noble St., Philadelphia, Pa. Editorial and Executive Offices, 30 Church Street, New York

Chicago: **105 West Adams St.**
Washington: **17th and H Streets, N. W.**
Cleveland: **Terminal Tower**
San Francisco: **215 Market St.**

Subscriptions, including 12 regular monthly issues, payable in advance and postage free. United States and possessions: 1 year, $3; 2 years, $5. Canada, including duty: 1 year, $3.50; 2 years, $6. Foreign countries: 1 year, $4; 2 years, $7.

The Railway Mechanical Engineer is a member of the Associated Business Papers (A. B. P.) and the Audit Bureau of Circulations (A. B. C.) and is indexed by the Industrial Arts Index and also by the Engineering Index Service.

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Annual Report of Bureau Of Locomotive Inspection

Twenty-first annual report shows further reduction in the number of locomotives found defective. Mr. Pack issues warning that the drastic economies now being practiced by the railroads may spoil record of improvement begun in 1923

THE twenty-first annual report of A. G. Pack, chief inspector, Bureau of Locomotive Inspection, to the Interstate Commerce Commission shows a further reduction in the number of locomotives found defective to eight per cent and a reduction in the number of accidents and casualties resulting from the same. In this report, however, Mr. Pack has issued a warning that the drastic economies now being practiced by the railroads will require energetic action on the part of the Bureau's inspectors if the excellent record of improvement since 1923 is to be maintained.

The fiscal year ending June 30, 1923, as shown in the chart, was the peak year for the number of locomotives found defective and likewise for accidents and casualties resulting from them. From that time up to and including the fiscal year ending June 30, 1932, the number of defective locomotives, accidents and casualties have continued to decrease. Although traffic compared to previous years has fallen off considerably, the total number of locomotives inspected in 1932 compares favorably with the number inspected in past years. During the fiscal year ending June 30, 1932, the Bureau's inspectors examined a total of 96,924 locomotives. In 1931 the number inspected amounted to 101,224; in 1930, 100,794; in 1929, 96,465; in 1928, 100,415, and 97,227 locomotives for the fiscal year ending June 30, 1927. Following is an abstract of Mr. Pack's report:

Result of an attempt to secure a main driving-wheel center to the axle by welding—The welding had failed and the wheel had worked out ⅛ in.

Mr. Pack's Report

During the year eight per cent of the steam locomotives inspected by our inspectors were found with defects or errors in inspection that should have been corrected before being put into use. However, the drastic economies now being practiced by the carriers, together with increasing traffic, will require energetic action on our part if the current conditions are to be maintained.

Condition of Locomotives, Found by Inspection, in Relation to Accidents and Casualties

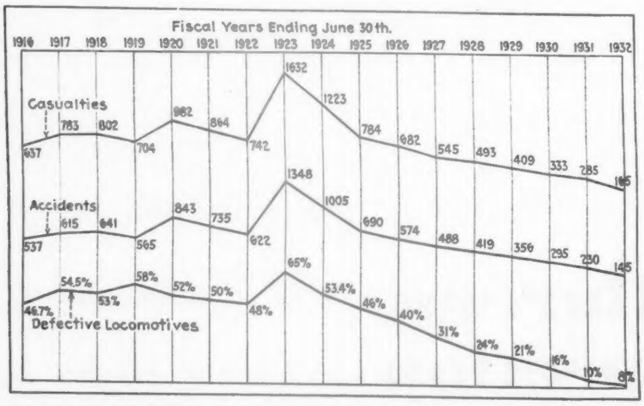
Fiscal year ended June 30	Per cent of locomotives inspected found defective	Number of locomotives ordered out of service	Number of accidents	Number of persons killed	Number of persons injured
1923	65	7,075	1,348	72	1,560
1924	53	5,764	1,005	66	1,157
1925	46	3,637	690	20	764
1926	40	3,281	574	22	660
1927	31	2,539	488	28	517
1928	24	1,725	419	30	463
1929	21	1,490	356	19	390
1930	16	1,200	295	13	320
1931	10	688	230	16	269
1932	8	527	145	9	156

The decrease in accidents and casualties brought about by decrease in defective locomotives, and the converse, are illustrated in the chart.

Detailed reports of our inspections of the steam loco-

motives of each carrier and a comparison of the condition of locomotives over a period of years show that some of the carriers are maintaining their locomotives in such condition as to meet the requirements of the law and the rules, while others were found to be seriously delinquent.

There was a decrease of 46.1 per cent in the number of crown-sheet failures, a decrease of 46.6 per cent in the number of persons killed, and a decrease of 75 per cent in the number of persons injured from boiler explosions as compared with the previous year.



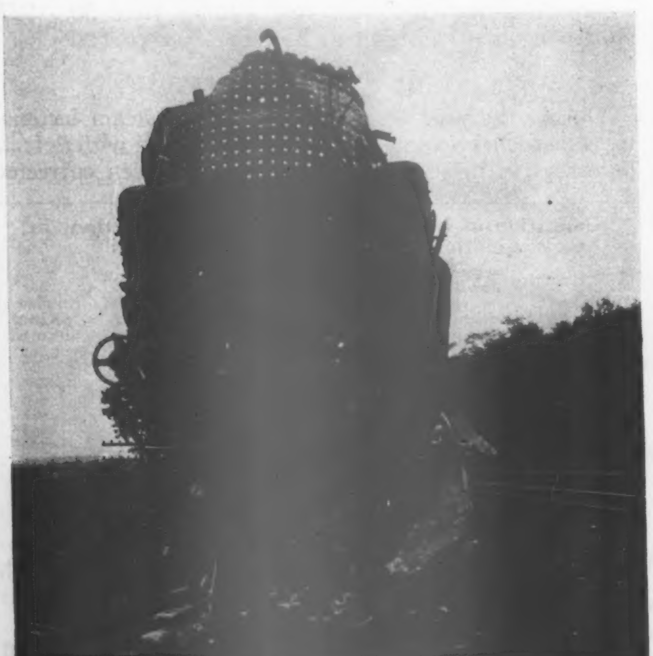
Relation of defective steam locomotives to accidents and casualties resulting from locomotive failures

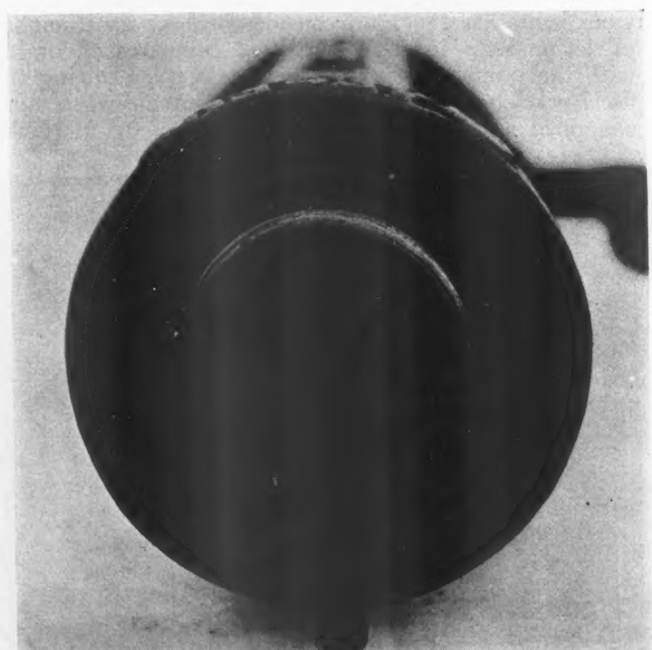
Extension of Time for Removal of Flues

A total of 644 applications were filed for extensions of time for removal of flues. Our investigations dis-

Number of Steam Locomotives Reported, Inspected, Found Defective and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30,— 1932	1931	1930	1929	1928	1927
1. Air compressors	417	481	873	1,202	1,282	1,679
2. Arch tubes	54	60	87	104	103	127
3. Ash pans and mechanism	69	81	76	132	133	192
4. Axles	13	10	12	20	7	13
5. Blow-off cocks	144	191	325	442	469	650
6. Boiler checks	214	263	521	761	914	1,043
7. Boiler shell	220	430	579	841	954	1,422
8. Brake equipment	1,645	1,923	2,706	3,894	5,214	6,572
9. Cabs, cab windows, and curtains	851	1,484	3,066	2,140	1,670	2,055
10. Cab aprons and decks	262	415	710	1,005	852	1,086
11. Cab cards	162	211	226	305	378	575
12. Coupling and uncoupling devices	85	98	122	154	179	289
13. Crossheads, guides, pistons, and piston rods	763	856	1,421	1,887	2,088	2,602
14. Crown bolts	50	96	95	129	164	235
15. Cylinders, saddles, and steam chests	841	1,265	2,311	3,210	3,264	4,526
16. Cylinder cocks and rigging	376	411	848	967	1,007	1,634
17. Domes and dome caps	45	83	154	227	281	388
18. Draft gear	325	568	950	1,310	1,453	2,037
19. Draw gear	371	640	1,003	1,367	1.650	2,210
20. Driving boxes, shoes, wedges, pedestals, and braces	821	925	1,359	1,993	1,990	2,710
21. Fire-box sheets	235	341	471	657	730	796
22. Flues	120	187	254	334	464	465
23. Frames, tailpieces, and braces, locomotive	611	740	1,271	1,377	1,354	1,682
24. Frames, tender	86	105	177	297	256	264
25. Gages and gage fittings, air	156	192	290	309	461	721
26. Gages and gage fittings, steam	214	324	553	678	969	1,425
27. Gage cocks	330	415	783	1,114	1,413	2,024
28. Grate shakers and fire doors	288	410	767	295	377	613
29. Handholds	382	562	865	1,125	1,373	2,285
30. Injectors, inoperative	31	55	103	86	93	84
31. Injectors and connections	1,168	1,815	3,275	4,484	5,563	7,188
32. Inspections and tests not made as required	3,801	4,862	7,456	9,246	6,623	8,889
33. Lateral motion	237	289	372	618	699	673
34. Lights, cab and classification	55	77	119	121	118	107
35. Lights, headlights	119	180	373	488	571	835
36. Lubricators and shields	119	176	312	423	500	746
37. Mud rings	166	318	445	636	822	1,073
38. Packing nuts	402	523	828	991	1,265	1,851
39. Packing, piston rod and valve stem	444	706	1,429	1,708	1,904	2,214
40. Pilots and pilot beams	145	160	272	371	386	507
41. Plugs and studs	176	182	348	482	619	740
42. Reversing gear	202	299	579	788	967	1,247
43. Rods, main and side, crank pins, and collars	1,256	1,520	2,488	3,465	4,152	5,137
44. Safety valves	63	61	116	170	172	212
45. Sanders	289	314	804	1,008	1,031	1,268
46. Springs and spring rigging	1,851	2,161	3,311	4,557	4,939	5,956
47. Squirt hose	96	184	313	387	478	644
48. Stay bolts	181	293	395	542	590	631
49. Stay bolts, broken	552	938	1,098	1,197	1,867	2,373
50. Steam pipes	285	512	730	925	1,020	1,308
51. Steam valves	143	226	399	471	708	774
52. Steps	622	676	1,021	1,394	1,817	2,440
53. Tanks and tank valves	587	732	1,426	1,717	1,941	2,747
54. Telltale holes	108	151	183	174	241	377



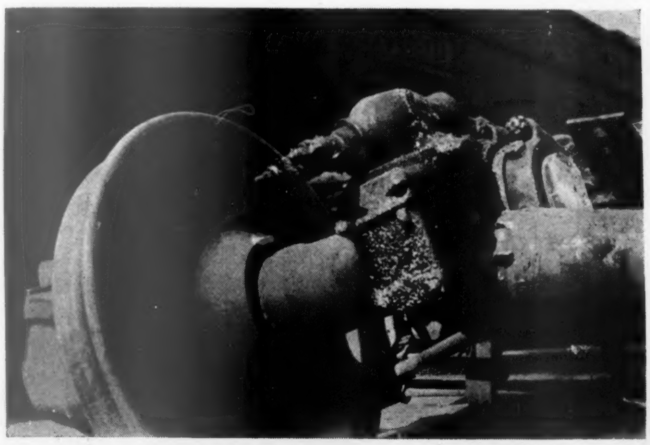


The clogged water glass shown at the right caused the crown-sheet failure at the left which resulted in the deaths of three employees

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30.— 1932	1931	1930	1929	1928	1927
55. Throttles and throttle rigging	434	574	1,175	1,554	1,889	2,233
56. Trucks, engine and trailing	648	714	1,141	1,605	1,914	2,363
57. Trucks, tender	766	1,059	1,531	2,144	2,610	4,114
58. Valve motion	520	497	827	1,067	1,262	1,568
59. Washout plugs	599	815	1,283	1,871	2,211	2,786
60. Train-control equipment	13	9	48	60	112	....
61. Water glasses, fittings, and shields	676	955	1,501	1,816	2,115	2,973
62. Wheels	603	750	1,025	1,325	1,609	2,119
63. Miscellaneous—Signal appliances, badge plates, brakes (hand).	325	418	691	1,101	1,273	1,511
Total number of defects	27,832	36,968	60,292	77,268	85,530	112,008
Locomotives reported	59,110	60,841	61,947	63,562	65,940	67,835
Locomotives inspected	96,924	101,224	100,794	96,465	100,415	97,227
Locomotives defective	7,724	10,277	16,300	20,185	24,051	29,995
Percentage of inspected found defective	8	10	16	21	24	31
Locomotives ordered out of service	527	688	1,200	1,490	1,725	2,539

closed that in 31 of these cases the condition of the locomotives was such that extensions could not properly be granted. Fifty-seven were in such condition that the full extensions requested could not be authorized, but extensions for shorter periods of time were allowed. Fifty-three extensions were granted after defects disclosed by our investigations had been repaired. Forty-nine applications were canceled for various reasons. Four hundred and fifty-four applications were granted for the full periods requested.

Under Rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 343 specification cards and 4,753 alteration reports were filed, checked and analyzed. These reports are necessary in order to determine whether or not the boilers represented were so constructed or repaired as to render safe and proper service, and whether the stresses were within the allowed limits. Corrective measures were taken with respect to numerous discrepancies found.



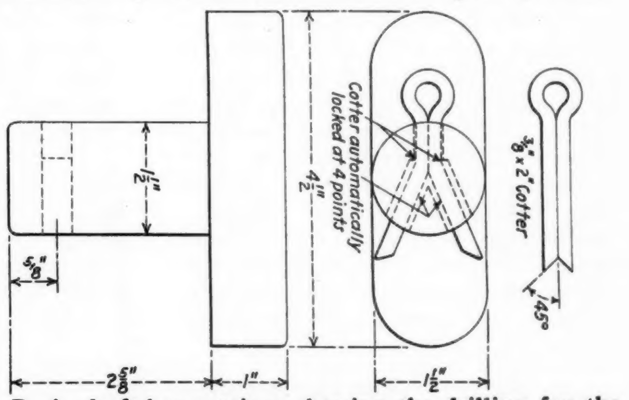
Broken tender-truck axle caused by welding brackets to the axle to prevent the retaining collar of the train-control transmission from shifting

Under Rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 50 specifications and 6 alteration reports were filed for locomotive units and 25 specifications and 13 alteration reports were filed for boilers mounted on locomotives other than steam. These were checked and analyzed and corrective measures taken with respect to discrepancies found.

One suit for penalties, involving 30 counts for placing locomotives in service while defective and in violation of the rules, was disposed of during the year. Judgment in favor of the government on six counts for $600 was obtained, while 24 counts were dismissed. No formal appeal by any carrier was taken from the decisions of any inspector during the year.

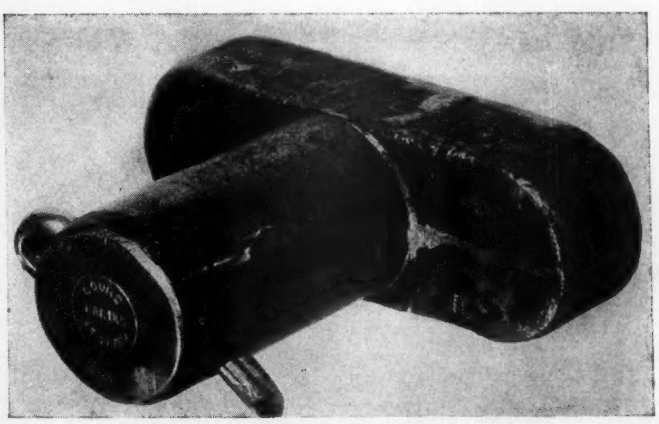
Draft-Key Retainers With Self-Locking Cotter

To eliminate the trouble experienced by many railroads of having cotter keys lose out of the A. R. A. draft-key retainers, the American Railway Products Company, Inc., 74 Washington street, South Norwalk, Conn., has adapted the Cooke self-locking cotter to this special application. This has been developed as an improvement over the application of a soft rivet in lieu of a cotter, as described in the November, 1931, issue of the *Railway Mechanical Engineer*.



A. R. A. draft-key retainer showing the drilling for the self-locking cotter

The Cooke cotter is an ordinary cotter with the prongs forming an internal *V* for easy spreading and the end of the retainer bored with a Y-shaped hole. The cotter is inserted in the proper hole and tapped lightly with a hammer. The first tap spreads the prongs of the cotter on the wedge formed by the intersection of the two lower holes. Further taps drive the cotter home, spreading the prongs at a wide angle and binding them tightly against the sides of the Y-shaped hole, locking the cotter firmly and thus eliminating vibration and the resulting wear.



Draft-key retainer with cotter in place

No additional bending of the cotter prongs is necessary. The Y-shaped hole is provided with shoulders above the wedge which prevent the cotter from entering any except the right hole, thereby making it fool proof. These shoulders also wedge the prongs by tending to create an S-curve.

Second Stainless-Steel Car with Pneumatic Tires

Reading receives second Budd-Micheline rail car — Powered with 125-hp. Diesel-electric plant built into one truck—Seats 47 passengers—Weight, 468 lb. per seated passenger

THE SECOND rail car of stainless-steel construction and equipped with pneumatic tires was recently delivered to the Reading by the Edward G. Budd Manufacturing Company, Philadelphia, Pa. This car is similar in essential characteristics to the first car delivered to the Reading by this company and described in the April, 1932, issue of the *Railway Mechanical Engineer,* page 137. It is 50 ft. 1 in. long overall, has a seating capacity of 47 passengers, and weighs 22,000 lb. complete, making a weight per seated passenger of 468 lb. This is an increase, compared to the first car, of about 128 lb. per passenger.

The car body weighs 8,200 lb. and is carried on two six-wheel, pneumatic-tired trucks. A Diesel-electric power plant consisting of a 125-hp. Cummings engine and a 250-volt Westinghouse generator of special light-weight construction is mounted with a storage battery on one of the trucks. On the second truck is mounted the driving motor.

The Power Units

Completely equipped, the power truck weighs 7,000 lb., of which the stainless-steel frame accounts for but 281 lb. The Diesel engine is placed so that it overhangs the axle at one end of the truck. It is directly connected to the generator which overhangs the outer axle at the other end of the truck. The storage battery, which is of 32-volt, 150-amp.-hr. capacity, is located in the truck between the engine and generator.

The control equipment is mounted on the power truck and consists of a modified torque control built by the Westinghouse Electric & Manufacturing Company. The water-jacket connection between the engine on the power truck and the car heaters in the body of the car is made by means of a standard radiator-type hose. Practically no flexibility on the part of this hose connection is required, because it is located at the center of the bolster swivel.

Fuel oil is carried in a tank slung under the car body and is connected to the engine by means of a hose. The engine is started by motoring the generator with power drawn from the storage batteries. These are charged from the main generator at idling speeds and at operating speeds by a Leece Neville 1,500-watt generator attached to the engine.

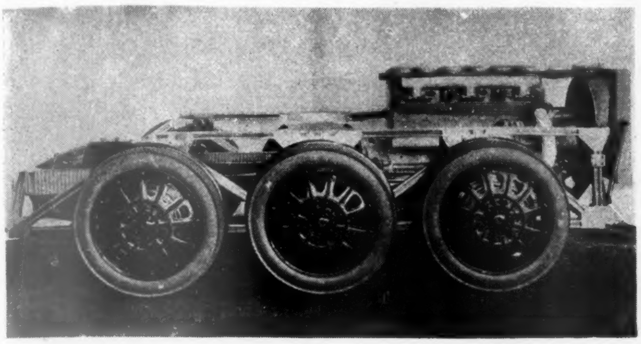
The engine is set low in the power truck. However, a slight elevation of the floor of the vestibule at the power-truck end of the car is necessary to provide proper clearance. For inspection purposes, the floor above the engine is constructed in sections which can be readily removed. The power plant is rendered accessible for maintenance purposes by lifting the front end of the car and rolling the truck out. By this method of engine mounting, engine noise, vibration and odor have been kept out of the car body and the center of gravity has been kept low.

The wheels under the power-plant truck do not drive the car. Driving is done from the truck at the opposite end of the car, which is equipped with a high-speed Westinghouse motor connected to the front and rear truck axles through universal joints and worm differentials. The gear ratio between the motors and wheels is 9 to 1. The outside diameter of the wheels is 35 in.

Pneumatic-tired rail car No. 65 built for the Reading by the Edward G. Budd Manufacturing Company

The driving truck is fitted with sand boxes arranged to sand the rails ahead of the driving wheels in either direction. The weight of the driving truck is about 4,300 lb., of which the stainless-steel frame accounts for 230 lb.

The car has an acceleration speed of 2 m.p.h. per sec. and is designed for a maximum speed of from 50 to 55 m.p.h. The deceleration rate can also be made



The power truck carries the engine, generator and storage batteries

high as compared with customary railway practice owing to the high factor of adhesion. The car can be stopped from a speed of about 55 m.p.h. in a distance of about 400 ft.

The Body Construction

The body construction of the new Reading car is similar to that of the first car in many respects. In the first car, however, the main load-carrying members were built in the form of Pratt trusses, 23 in. deep, which formed the side members of the underframe. The body was built around this under structure and was not included in the structure stress calculations. In the Reading car No. 65 the builders use the window sill and lower skid moldings to constitute the truss chord members. The side posts are the vertical members of

View of one of the operator's cabs—The car is arranged for double-end control

the Pratt truss and the diagonal members are added to complete the truss.

The illustration of the car while under construction in the shop shows the new features which have been incorporated into the design of the new car. The diagonal member, which weighs 75 lb., was the only metal added for the side-frame construction. The partitions separating the seating compartment from the front and rear vestibules are supported by the roof. Wide dead-light panels on both sides of the door tie the roof to the rest of the body structure, a feature which tends to strengthen and stiffen the car body. The only parts of the body not taking primary stresses are the external body panels which are made of light-weight stainless steel and fluted so they will not buckle or weave under the most severe deflection encountered in normal service. The floor has been changed from plywood to corrugated stainless steel. This floor construction provides greater rigidity and also serves as a lateral bracing. The unit type of construction for the roof, side frame, floor and partitions also provides increased resistance to weaving of the car body. The main structural members of the car body weigh about 900 lb. The total weight of the body is 8,200 lb., of which 3,700 lb. is stainless-steel construction.

The stainless steel is used in the form of thin sheets. These sheets are formed into structural members which

The drive truck—The middle wheel has been removed to show the frame and spring construction

are "shot welded"* together. Similar sheets are used to enclose the body structure. All stainless steel used in the construction is cold worked to a tensile strength of 150,000 lb. per sq. in. No protective coatings are required to prevent corrosion.

The interior design and arrangement is simple. The large window area on all sides and ends which provides an unobstructed view in every direction makes for a pleasing interior. The roof is of turtle-back construction and the ceiling extends down in a smooth curve to the top of the windows. The passenger compartment is 31 ft. 1½ in. long. It is fitted with reversible double seats 40 in. wide with a 26-in. aisle between. The frames of the seats are of steel tubing and drop forgings fitted with leather-covered rubberized-hair upholstery. Each seat weighs about 52 lb. Arm rests are provided next to the aisle. A seat is provided in the rear vestibule which will accommodate three persons. The floor is of welded corrugated stainless steel covered with cork tiling.

The vestibules are about 8 ft. in length. Side and trap doors, centrally operated by air control, are pro-

* See the *Railway Mechanical Engineer*, April, 1932, page 139.

vided over the steps. Folding steps which extend below the body of the car, which are also operated by the compressed-air control, are provided.

Following somewhat the design of the first car, a central duct, dropped below the ceiling, extends throughout the length of the passenger compartment to provide for wiring, lighting and ventilators. Light from sources

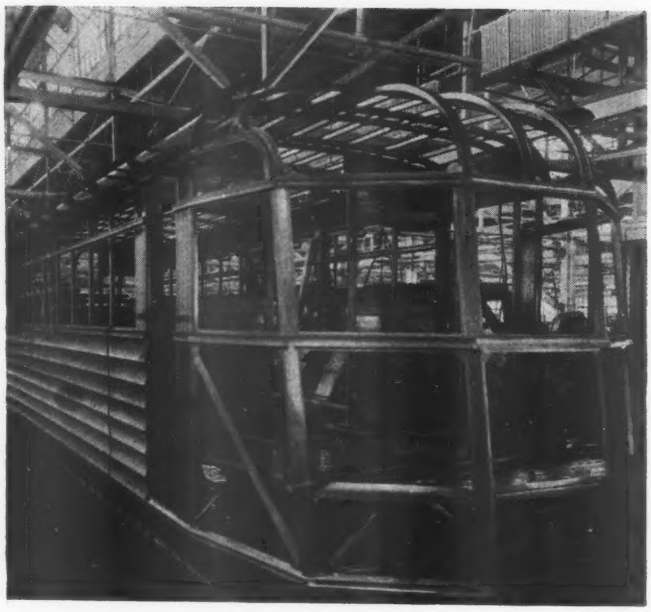
Dimensions and Weights of the Budd-Micheline Rail Car No. 65 Built for the Reading

Railroad	Reading
Builders	Edward G. Budd Mfg. Co.
Service	Passenger
Power plant:	
Diesel engine	125-hp. Cummings
Generator	250-volt Westinghouse
Speed	50 to 55 m.p.h.
Braking	Stops in 400 ft. from 55 m.p.h.
Dimensions:	
Length overall	50 ft. 1 in.
Inside width	9 ft.
Outside width (to clear)	9 ft. 11 in.
Height above rail	11 ft. 5 in.
Height floor to ceiling	7 ft. 5¼ in.
Length of passenger compartment	30 ft.
Length of vestibule	8 ft. 11½ in.
Height vestibule floor to ceiling (over power plant)	6 ft. 10¾ in.
Width of vestibule doorways (to clear)	27 in.
Distance between truck centers	30 ft. 1 in.
Truck wheel base	6 ft. 8 in.
Tires	35 in. by 5½ in.
Tire air pressure	100 lb. per sq. in.
Seating capacity	47
Weights:	
Body	8,200 lb.
Truck and power plant, complete	7,000 lb.
Driving truck	4,300 lb.
Controls, wiring and miscellaneous	2,500 lb.
Total weight	22,000 lb.

in the sides of this duct is distributed by reflection from the headlining and sides of the car above the windows. Twenty-two 15-watt lights are used in the car behind Holophane lenses.

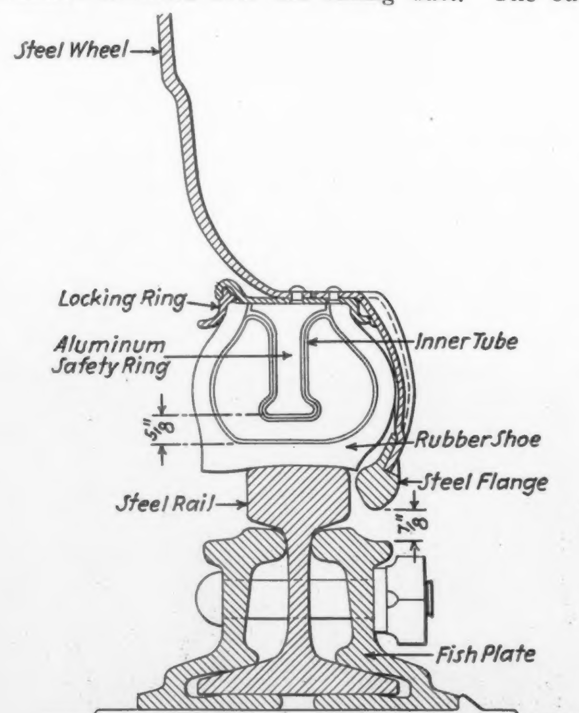
The car is indirectly heated by hot water from the engine jacket under thermostatic control. The hot-water heaters are located in the car body underneath the car seats next to the body partition separating the operator's compartment and the car body. The air is circulated by means of Sirrocco blowers through the heaters and

Interior of Reading Car No. 65



Car during the process of construction

throughout the car by ducts on either side of the car body at the floor line. The air is exhausted through roof ventilators mounted over the ceiling duct. The outlet



Cross-section of the wheel, tire and flange

from the car interior is through grilles in the sides of the ducts. The windows are permanently closed.

Wheels Have Pneumatic Tires

The wheels, of Budd design, are of the removable disc type and accommodate Micheline-Goodyear pneumatic tires which are furnished exclusively to the Budd Company. Following the Michelin principle to prevent interference between the metal flange and the track in case of deflation, a solid metal ring mounted on the tire rim projects outward inside the 35-in. by 5½-in. tire, to a point within ⅝ in. of the inside of the loaded tread under normal inflation of 100 to 115 lb. per sq. in. The

load-carrying capacity, based on a life of 25,000 miles, is 2,400 lb. per tire. The wheel and tire are designed to run with a deflated tire as far as it may be necessary until it is practicable to make repairs. The axles are mounted on Timken roller bearings and support the truck through large diameter coil springs, one in each pedestal. Brakes of the internally expanding type, operated by the Bendix-Westinghouse air-brake, are installed on the four outside wheels of each truck. Tru-Stop hand emergency brakes operate on the two middle wheels of each truck.

Car Equipped for Double-End Control

The car is arranged for double-end control. At each control station the oil pressure, water temperature and speed indications are all relayed by light circuits. Standard head and signal lights are built into the body. The insulation of the car from the tracks, effected by the rubber tires, requires special equipment for the purpose of signal operation. A means of providing for this has been developed by the Budd Company in co-operation with the Union Switch & Signal Company. As installed on this car, it consists of four pairs of rocking brushes supported between the wheels on the trucks and energized by an auxiliary circuit.

The cost of operating the car is placed by the builders at about 12 cents per mile, which includes fixed charges as well as direct mileage costs, but exclusive of crew. A month's operation of the first car, during which it traveled 2,150 miles and carried 2,181 passengers, was $24.96 for fuel and lubricating oil.

Double-Disc Driving Wheel

A NEW locomotive driving wheel, made of cast steel and comprising, essentially, a double-disc construction, instead of the conventional spoke design, has been developed by the Scullin Steel Company and tested during the past 13 months on a number of roads, including the St. Louis-San Francisco, the Missouri Pacific and the Denver & Salt Lake. A complete set are also installed on a New York Central freight locomotive. In general, as a result of these tests, the practicability of the new design has been demonstrated. Advantages claimed for it include a saving of about 10 per cent in weight and an increase of 50 per cent in strength in a lateral direction over the conventional locomotive driving-wheel design. In addition, the new design permits readily counterbalancing much more than the usual weight of reciprocating parts, a feature which is often a limiting factor in locomotive design.

Details of Counterbalancing Calculations for the Wheel Shown in the Drawing

Revolving weights, lb.		Reciprocating weights, lb.	
Back end of main rod	781	Piston and rod complete	916
Main side rod	842	Crosshead shoe and pin	618
⅔ eccentric crank	126	Union link	48
Main-rod fit (crank pin)	162	Front end (main rod)	385
Side-rod fit (crank pin)	136	Total	1,967
Hub fit (crank pin)	147	Balance, 50 per cent of total	984
Eccentric-crank fit (crank pin)	23	Balance in main wheel	246
Crank-pin hub	176		
Total	2,393		

Eccentric crank and pin
$(126 + 23) \times 83\frac{3}{4}$ in. = 12,479
Main rod and pin
$(781 + 162) \times 77\frac{3}{8}$ in. = 72,965
Side rod and pin
$(842 + 136) \times 69\frac{1}{4}$ in. = 67,727
Hub and pin
$(176 + 147) \times 62\frac{1}{4}$ = 20,107
$2,393 \times 72.4 = 173,278$

$\frac{173,278}{2,393} = 72.4$ in. center of gravity

$\frac{2,393 \times 72.4}{62\frac{7}{8}} = 2,756$ lb.

$\frac{2,393 \times 9.53}{62\frac{7}{8}} = 363$ lb.

Tan angle of balance $= \frac{363}{2,756} = .1317 =$ Tan 7 deg. 30 min.

$\sqrt{363^2 + 2,756^2} = 2,780$ lb. at crank-pin distance

$\frac{2,780 \times 14}{16\frac{7}{8}} = 2,305$ lb. revolving weight

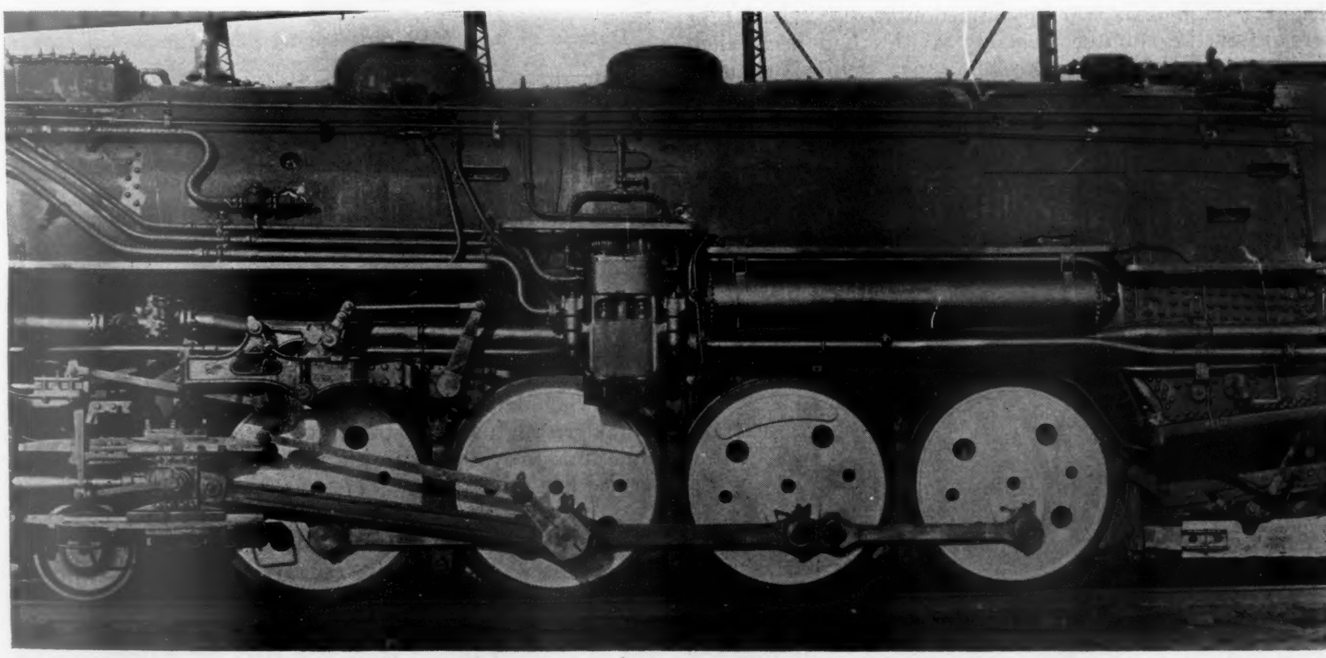
$\frac{246 \times 14}{16\frac{7}{8}} = 204$ lb. reciprocating weight

2,306 lb. + 204 lb. = 2,510 lb. total to balance

Shell = 342 lb.	2,582 lb. obtainable
Lead = 2,240 lb.	2,510 lb. required
Total = 2,582 lb.	72 lb. allowance

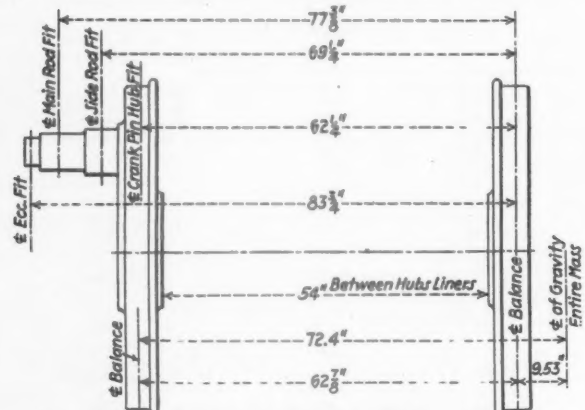
Center of gravity of balance from center of wheel = $16\frac{7}{8}$ in.

The double-disc driving wheel is a radical departure from the conventional spoke design, both from the manufacturing and mechanical standpoints. The wheel is made of practically a uniform section of metal throughout, with the exception of an increase in the thickness in the metal surrounding the axle and crank pin. However, the crank pin and main hubs are both lighter in section than the conventional spoke design. The discs are con-



A New York Central freight locomotive completely equipped with double-disc driving-wheel centers

tinuous from the rim to the hubs. From the foundry standpoint the design is superior to the spoke wheel as it is less affected by shrinkage strains. The continuous discs enable the wheel to resist the stresses due to shrinking on of tire and prevent warping. The study of many actual tests indicate that, when tires are shrunk on, the warping of wheel rims is less than 1/10 that of the spoke design. The discs continuously support the rim and

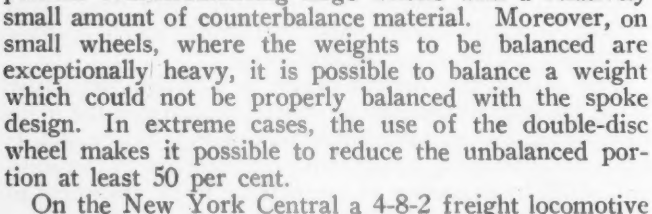


Dimensions used in the counterbalancing table

prevent flat spots, necessitating shimming. Suitable holes, closed with pipe welded in the discs, are located in the wheel centers to enable the removal of rod knuckle pins, crosshead pins and spring-rigging pins.

The rim of the double-disc wheel is of a relatively light cross section, due to the reinforcing action of the discs, which also are lighter than the spokes. This fact permits counterbalancing large wheels with a relatively small amount of counterbalance material. Moreover, on small wheels, where the weights to be balanced are exceptionally heavy, it is possible to balance a weight which could not be properly balanced with the spoke design. In extreme cases, the use of the double-disc wheel makes it possible to reduce the unbalanced portion at least 50 per cent.

On the New York Central a 4-8-2 freight locomotive with 69-in. driving wheels has been equipped with a complete set of the double-disc driving wheels. The eight wheels for this locomotive, with the standard spoke design, weighed 22,400 lb. The double-disc wheel centers, after the counterbalancing cavities had been filled with lead, weighed 20,406 lb., a net saving of about 2,000 lb. in favor of the double-disc type. In applying the new wheels advantage was taken of the opportunity



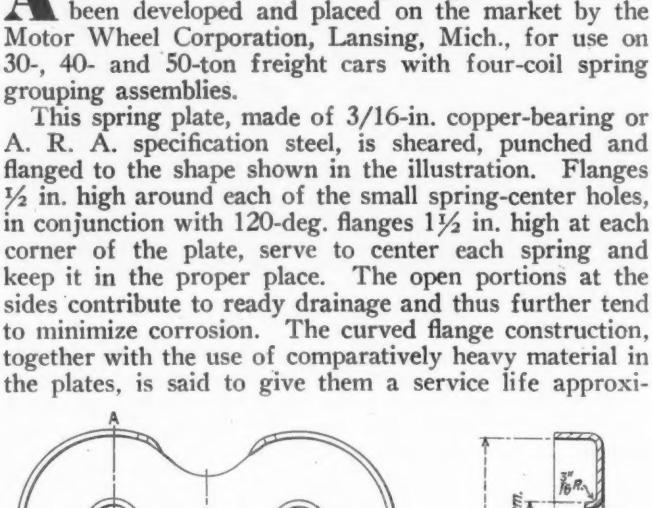
Details of double-disc main driving-wheel center installed on the St. Louis-San Francisco

to cross-balance the locomotive and the weight named for the double-disc wheels includes 866 lb. of lead which was the necessary addition for cross-counter-balancing. The double-disc wheel center castings for this locomotive weighed 14,890 lb. before counterbalancing.

Spring Plate Developed for Freight Cars

A NEW MW-type railroad spring plate has recently been developed and placed on the market by the Motor Wheel Corporation, Lansing, Mich., for use on 30-, 40- and 50-ton freight cars with four-coil spring grouping assemblies.

This spring plate, made of 3/16-in. copper-bearing or A. R. A. specification steel, is sheared, punched and flanged to the shape shown in the illustration. Flanges ½ in. high around each of the small spring-center holes, in conjunction with 120-deg. flanges 1½ in. high at each corner of the plate, serve to center each spring and keep it in the proper place. The open portions at the sides contribute to ready drainage and thus further tend to minimize corrosion. The curved flange construction, together with the use of comparatively heavy material in the plates, is said to give them a service life approxi-



Details of new MW-type spring plate for 50-ton cars

mately three times as long as the ordinary spring plate.

The principal advantage of the MW-type spring plate is the elimination of the center bolt, required with standard A. R. A. spring plates, due to the fact that the curved flanges, while permitting free movement of the springs, is designed to prevent any possibility of spring loss. A. R. A. standard dimensions are adhered to in all details of the spring plate, with a view to adapting it to use with all A. R. A.-type springs and all types of spring planks.

The Motor Wheel Corporation, which has previously manufactured standard spring plates is offering the new MW-type plate with a view to eliminating spring loss at modern high freight-train operating speeds and at the same time providing a spring plate with greatly-increased service life.

IN ENGLAND, THE RAILWAYS WILL DO ANYTHING—There is no length to which the British railways will not go in order to get traffic. Not only will they carry anything anywhere, but recently, in addition to distributing traffic, the railways have undertaken a supplementary task. Where this service is desired, railway employees will unpack shipments and even place them on shelves in shops.

Modern Locomotive Valves And Valve Gears Analyzed

Part 1

By Walter Smith[1]

A discussion of present gears and the extent to which they give effective control of steam distribution

During nearly a century of locomotive development in this country, there have been no striking innovations in valve and valve-gear design. It is a matter of historical record that only a very few types of distribution valves and valve gears have survived the test of time, in spite of the fact that inventors and improvers have spent a vast amount of effort in an attempt to improve the efficiency of locomotive steam distribution.

Without question, the greatest progress in locomotive design has been made since 1905, and the most intensive development has taken place during the past 15 years. It is a significant fact that the Walschaert valve gear was introduced in this country in 1904 about the time these unusual developments began, and has played an important part in bringing about better locomotive performance.

The piston valve was used to some extent prior to the introduction of the Walschaert valve gear, but it did not become standard until 1910 when the superheater came into general use. Theoretically, no improvement in steam distribution was accomplished when the slide valve and Stephenson valve gear were displaced in favor of the piston valve and Walschaert valve gear, but from a mechanical and operating standpoint a great deal was gained.

Further developments in locomotive design will doubtless include the use of increased boiler pressures and still higher superheat temperatures. The author of this article believes this will necessitate discarding the present piston valve, with sliding metal surfaces, in favor of some type of poppet valve with a rugged valve mechanism to provide separate control of admission and exhaust valves and give rapid and wide openings at short cut-offs.

Exacting Requirements of Modern Service

While present radial valve gears may leave something to be desired in the way of efficiency, they are the only valve gears so far developed that have demonstrated the ability to stand up to the extremely severe requirements of modern locomotive service in this country, where long runs at high sustained speeds, and intensive use of motive power, are common practice. The recent trend toward increased boiler pressure, higher superheat, and longer valve travel has imposed still greater duty on the distribution valves and their actuating mechanisms.

There is no disputing the fact that high speed is the crucial test of a valve gear. It is only necessary to consider that at diameter speed the movement of a distribution valve must be reversed approximately 672 times a minute and that power is required for its reciprocation in proportion to its weight times the number of feet of travel, to conceive of the very severe shocks and stresses to which a valve gear is subjected. That the detrimental effect of long travel on the valve gear increases as the speed builds up is shown by the fact that the momentum of a moving body increases as the square of its velocity. Tests have shown that the power absorbed by the Walschaert valve gear, actuating piston valves of moderate travel, varies from 10 to 60 hp., according to conditions of speed and cut-off. Longer valve travel necessarily requires greater driving power.

Piston valves are not perfectly balanced and high-pressure steam causes increased frictional resistance, because of the higher pressure under the rings tending to expand them. Furthermore, in practice, valves are not in perfect alinement, and with high superheat, good lubrication is difficult to attainment. The result is that valves frequently become cut and scarred, causing an unusual load on the valve gear. Any springing or yielding of the valve-gear parts under these conditions results in vibration, wear and tear, distorted valve events, loss of efficiency, and eventually in failures.

In order for a valve gear to meet successfully present-day operating conditions, the following characteristics are required:

(1) Capacity for long valve travel in order to insure effective steam distribution.

(2) Dependability, or assured reliability in service.

(3) Rigidity and stability to eliminate vibration, and insure positive valve actuation with permanence of adjustment.

(4) Longevity, or resistance to wear and freedom from lost motion after prolonged service periods.

(5) Accessibility and ease of maintenance.

(6) Ruggedness without the use of excessively heavy moving parts.

(7) Mechanical and structural simplicity.

(8) Minimum shocks and duty on the reversing mechanism.

This combination of requirements is indeed rigid,

[1] Formerly associated for a period of 14 years with O. W. Young in the development of long-travel gears and subsequently with the Pyle-National Company in the promotion of limited cut-off. The present article is divided into three parts, the first of which appears in this issue. Subsequent installments will include: Part II—A study of the effect of limited cut-off and long valve travel on locomotive capacity; and Part III—An explanation of the limitations and possibilities of steam-distribution valves.

and can only be met satisfactorily when a valve gear possesses certain inherent characteristics pertaining to leverage relations and when the following features are embodied in the design and construction: First, rigid bearings of ample proportions to minimize wear; second, straight thrusts without objectionable angularities; third, pins in double shear; fourth, material in moving parts of high physical properties with superior shock resistance and impact values.

Walschaert and Baker Valve Gears

Only the Walshaert and the Baker valve gears need be given serious thought at present because they are the only ones that have been able to meet the exacting requirements and hold their place in American locomotive service. Within its limitations of valve travel, the Walschaert valve gear, when well designed, admirably meets the requirements of modern locomotive service. Its limit of capacity is 8 or 8½ of travel, and, when designed for longer travel, it loses some of its most desirable characteristics. This valve gear is best designed with a comparatively short throw of the eccentric crank and with a long link. Thus, small working angles are obtained, which result in a smoothly working valve motion. In order to design the Walschaert gear for a 9-in. valve travel, an excessive link swing (50 deg. or more) must be used, and, unless the main rod is exceptionally long, the eccentric rod and radius bar angles are objectionable. This results in a wedging action of the link block in the link, which has a detrimental effect even when an unusually long link block is used.

A power lever arrangement has been developed on the Atchison, Topeka & Santa Fe[1] which makes it possible to obtain an extremely long valve travel from the Walschaert valve gear without exceeding the normal limits of angularity. The power lever is interposed between the radius rod and combination lever, and pivoted at the rear end of the backvalve—chamber head. The motion obtained from the link is magnified without affecting the motion produced by the combination lever. This device affords a simple method of obtaining an extremely long valve travel without stressing the valve gear beyond safe limits. The full travel possibilities of this arrangement were utilized on a recent application in which a maximum travel of 9⅞ in. was specified.

The Baker valve gear is in reality a modified Walschaert valve gear in which the link and link block have ben substituted by members of the pin and bushing type. With valves arranged for the same travel, steam lap and lead, there is practically no difference in the valve movement derived from the Walschaert and the Baker valve gears. However, the Baker gear has greater travel capacity, and the recently-developed long-travel Baker valve gear, designed for 9 in. travel, has demonstrated it ability to meet all of the requirements of the most exacting device.

Valve Movement Derived from Present Valve Gears

Due to the errors inherent in all radial valve gears which depend on the transformation of circular into linear motion, present valve gears are only approximately correct in their control of steam distribution. However, these irregularities can be reduced to the point where they do not affect either the power or the economy of the locomotive. In order that errors may be reduced to a minimum, and the best combination of event of the stroke obtained for all speeds and all points of cut-off, the utmost care is required in the design.

[1] See page 377, July, 1928, *Railway Mechanical Engineer.*

The greatest limitation of present valve gears is that they give a restricted port opening when working at a short cut-off. The introduction of long valve travel with valves arranged for wide steam lap, has accomplished a substantial increase in short cut-off port openings, but still there is much to be desired at high speed when the time interval for admission is very short (only about 1/30 sec. at 25-per cent cut-off and 80 m.p.h. with 75-in. driving wheels).

Formerly, when there was a demand for increased capacity, the locomotive designer resorted to larger cylinders without any attempt to increase boiler pressure. This method of obtaining high-power output taxed the distribution valves and their actuating mechanism to the limit, because large volumes of steam had to be handled at short intervals. In some cases, piston valves of the largest permissible diameter were used in an attempt to obtain greater areas for admission and exhaust, but still the horsepower output at high speed was restricted.

The recent trend in locomotive design toward increased boiler pressure, higher superheat and larger driving wheels has done much to counteract the loss through wire-drawing of the steam into the cylinders at high speed, and short cut-offs for the following reasons:

(1) The highly vitalized steam flows with much greater velocity through the ports.

(2) There is a lesser volume of steam required because of the comparatively small cylinders used in connection with high boiler pressure.

(3) The higher driving wheels give a longer time interval for steam action.

It is also characteristic of present valve gears that the motion causes an early release in the shorter cut-offs (at approximately two-thirds of the stroke at 25-per cent cut-off). This feature shortens the expansion period, and, from that standpoint, is undesirable; but it makes higher speeds posssible by providing a longer time interval for expelling steam from the cylinders.

Mean Effective Pressure Measures Power and Efficiency

The present demand for increased cylinder horsepower capacity with the maximum developed at higher speed requires a high mean effective pressure. Mean effective pressure is the force that pulls a train; it is a measure of the work done and the power developed. Mean effective pressure is dependent on the following vital factors: Initial boiler pressure; degree of superheat; back pressure on the pistons; distribution and utilization of the steam.

The importance of steam distribution and utilization cannot be over-estimated. It is next to the boiler in determining the efficiency of the locomotive as a whole. Mean effective pressure is the basis on which the efficiency of steam distribution and utilization should be gaged. The best possible valve and valve-gear arrangement is the one that will develop, for every point of cut-off and for every speed, the highest mean effective pressure, with the greatest economy, and with the smallest horsepower loss from back pressure. The mean effective pressure developed, and the corresponding steam consumption for given speeds and cut-offs, should be the standard of comparison for determining the efficiency and economy of different valve and valve-gear arrangements.

Steam Consumption.—The present-day necessity for high horsepower output, with the maximum delivered at higher speed, requires large boiler capacity and effective and economical use of steam. Horsepower should increase with every increment of speed, unless the boiler capacity is limited or unless the valves and their actuating

mechanism impose restrictions on the flow of steam to and from the cylinders.

Any improvement in steam distribution, or utilization, which reduces steam consumption in the cylinders is virtually the same as an increase in boiler capacity, because the volume of steam taken from the boiler is lessened at the same power output.

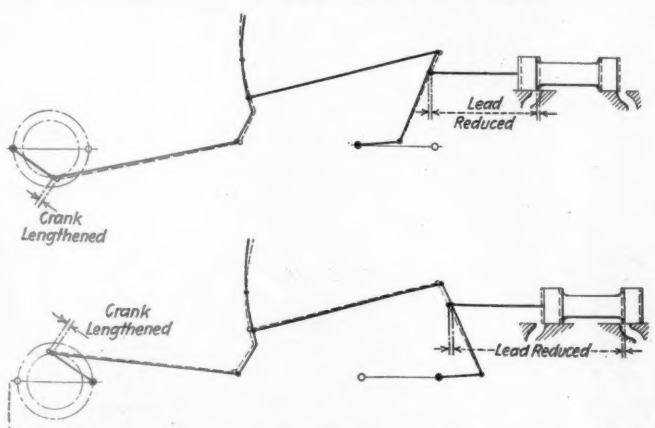
From the standpoint of steam distribution and utilization, there are three principal methods by which reduced steam consumption can be accomplished:

(1) An increase in m.e.p. by reducing wire-drawing, lowering the back pressure, and by obtaining the best cycle of valve events.

(2) Reducing the cut-off and delaying the release, thereby increasing the expansion ratio.

(3) Utilizing compression to obtain the maximum m.e.p. for a given steam supply. This requires a final compression pressure not far below initial pressure.

It is worthy of note that present operating methods are in the direction of economy, for the reason that the



Variable lead—Lengthening the eccentric crank reduces the lead in forward motion; in backward motion, the lead is correspondingly increased

efficiency of both steam production and steam consumption are slightly increased with increasing speed.

Since the introduction and use of 300 deg., or more, of superheat, together with higher pressure, and better steam distribution, the steam consumption in locomotive cylinders has been materially reduced. Steam rates as low as 15 or 16 lb. per hp. hr., at maximum capacity, are now common.

Control of Steam Distribution.—There is probably no subject pertaining to locomotives on which there is greater misunderstanding and wider difference of opinion than the arrangement of details of the valves and valve gear which control steam distribution. By steam distribution is meant the action of consecutive piston pressures.

The basis for an analysis of locomotive steam distribution must necessarily be a consideration of the factors and details which govern the functioning of the distribution valves, and their actuating mechanism.

Steam Lap.—Without question, steam lap is the most important factor in steam distribution. It determines the travel and velocity of the valve at short cut-offs, causes expansion and pre-release, and has a decided effect on the width of admission and exhaust port openings. The improvement in steam distribution accomplished by long valve travel, and the limited cut-off, is due to an increase in steam lap. An increase in steam lap shortens the range of cut-offs, unless the valve travel is proportionately increased. An increase in the steam lap affects the form of the indicator card as follows:

(1) It raises the steam and expansion lines, and lowers the exhaust and compression lines.

(2) Indicator cards are sharpely defined, showing increased speed of opening and closing the ports, as well as larger port openings.

(3) Terminal exhaust pressure is lower, due to a later release and longer ratio of expansion.

(4) Terminal compression is higher, due to an earlier closure, but not too high to cause negative work.

(5) An Improvement in the combination of events of the stroke is effected.

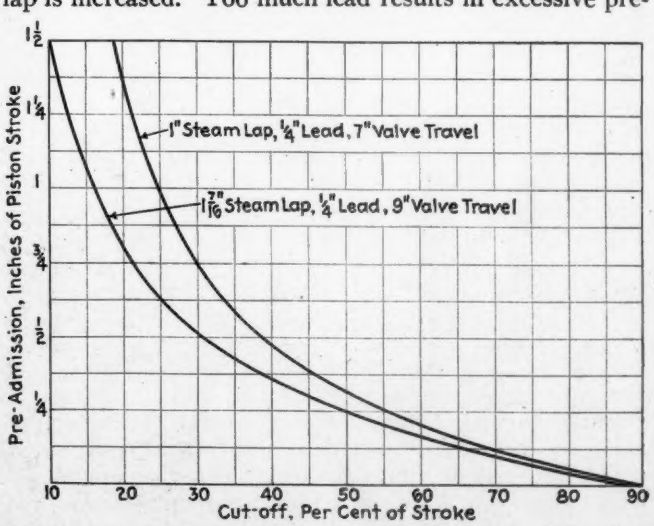
In connection with the foregoing, it should be noted that the improvement in terminal pressures is due to the reduction, or elimination, of exhaust clearance which is made possible by an increase in steam lap. It is well known that the most efficient use of steam is obtained with the greatest ratio of m. e. p. of the indicator diagram to the terminal pressures of the diagram. The m. e. p is a measure of the work done, and the terminal pressure is the cost of doing the work.

Lead and Pre-admission.—It is characteristic of present valve gears that the lead is constant and the pre-admission variable. Lead is the width of the port opening at the beginning of the stroke, and pre-admission is the distance the piston must move to complete the stroke after the valve begins to open for lead. Lead is of no great importance, except as it influences other events, and as it contributes to the maximum port opening at a short cut-off.

Port opening in the early cut-offs is simply the lead plus a small increment, depending on the ratio of lap and lead to valve travel. Unless valves are arranged for a very wide steam lap, considerable lead is necessary in order to secure effective port opening. However, it is not advisable to use more than ¼in. or 5/16 in. lead at a maximum, for the reason that the advantage of any additional port opening secured by means of a greater lead is more than offset by the increase in compression and pre-admission.

Starting Power Not Retarded by Lead in Full Gear

It is a common misconception that starting power is retarded by lead in full gear. Lead causes pre-admission, but in full gear the valve movement is so rapid while uncovering the port that ¼ in. lead causes only 1/16 in. pre-admission. Pre-admission increases as the cut-off is shortened, as shown in the chart. It is also worthy of note that pre-admission at every point of cut-off is less for a given amount of lead when the steam lap is increased. Too much lead results in excessive pre-



Relation between pre-admission and the point of cut-off for wide and narrow steam laps

admission at short cut-offs; for efficiency and smooth working conditions, pre-admission should not be more than one inch at 25-per-cent cut-off.

Variable Lead.—A great deal has been said and written, from time to time, on the relative merits of a variable and constant lead. It is the usual contention that locomotives with a variable lead setting are more reliable in starting than those with a constant lead; from the foregoing, it is apparent that considerable full-gear lead does not cause enough pre-admission to retard starting power. However, it results in too early a maximum cut-off unless the steam lap and valve travel are properly proportioned. Therefore, a reduction in full-gear lead has practically the same effect in lengthening the maximum cut-off as that by an increase in valve travel.

With the variable-lead arangement, the valve events are delayed up to 25-per cent cut-off, due to the fact that a reduction in lead retards the cycle of events of the stroke. The valve events at the 25-per cent cut-off, or running position, are usually arranged so that they are the same as for constant lead.

The valve gears used at present normally give a constant lead, but there are two methods by which they may be arranged to give a variable lead. The method most commonly used involves no complication whatever. In the usual design of valve gear in which the eccentric crank follows the main pin in the forward motion, the length of the eccentric crank is increased so that it will give the required throw when set to lag behind the true position for constant lead, as shown in the diagram. However, the beneficial effects obtained from a reduction in lead in full gear forward is obtained at the expense of distorting the back motion. The full-gear back-motion lead is increased in the same proportion that the full-gear forward lead is reduced.

The other method offers the advantage of a uniform variation in lead in both forward and back motions, but requires a special attachment for its operation.[3] With this arrangement, the short arm of the combination lever is slotted, and the pin in the front end of the radius bar is provided with a block which slides in the slot. The block has a travel a about 1½ in. in the slot, and its position is regulated by a bell crank and connecting link which is operated in connection with the main reverse shaft. Thus, the distance, center to center, between the pin connection to the valve stem, and the pin connection to the radius rod, is varied with changes in cut-off.

Exhaust Clearance.—Exhaust clearance, sometimes termed exhaust lead, functions on the exhaust side of the valve in much the same manner as lead on the steam side. It not only hastens release and retards compression, but widens out the exhaust opening as well. Since the expansion period is shortened and compression reduced by an increase in exhaust clearance, it is apparent that a loss in efficiency will result if more is used than conditions justify. The detrimental effect of too much exhaust clearance is very noticeable at high speed, especially if a comparatively large exhaust nozzle is used. The reciprocating parts are not properly cushioned, and there is excessive vibration throughout the whole locomotive. Exhaust clearance has a flattening effect on the form of the high-speed indicator card.

The exhaust opening at the end of the stroke is a function of steam lap, lead and exhaust clearance, and, when this opening is widened due to an increase in steam lap, the exhaust clearance should be proportionately reduced. This fact does seem to be fully recognized for there is still a tendency to use too much exhaust clearance with the wide steam-lap arrangement. Contrary to the general belief, exhaust clearance is not required for high-speed performance unless the exhaust opening is restricted, due to a narrow steam lap. The valve arrangements shown in the table are typical examples of good practice in the proportioning of exhaust clearance to steam lap.

Exhaust clearance by timing release and closure, and contributing to exhaust opening, affects back pressure and compression. As there are other factors which influence back pressure and compression, these should be considered in arranging the exhaust clearance. These factors are boiler pressure, superheat, diameter and stroke of cylinders, piston speed, cylinder clearance, size of exhaust nozzle, and diameter of distribution valves.

Back Pressure and Compression

The width of the exhaust opening at the end of the stroke is a factor of greater importance than exhaust clearance in its effect on back pressure and compression. In order to insure low initial back pressure and that the final choking of the exhaust will come at the exhaust nozzle and not at the valve, the exhaust opening at this point must be as wide as practicable. Back pressure increases with speed due almost entirely to the shortened time interval for the escape of steam and, unless the exhaust opening is of very liberal proportions, it is necessary to lengthen the exhaust period and widen the opening by increasing the exhaust clearance. Wide steam lap, made possible by long valve travel, insures liberal exhaust opening.

Exhaust clearance determines the actual closure point, but the exhaust port opening has the greatest effect on compression, for the reason that with lowered back pressure, the pressure initially subject to compression is lower, resulting in a lower terminal compression. Compression builds up with speed and back pressure, and may become excessive if not properly controlled. Excessive compression can be detected in the cab by a tendency for the locomotive to jig at high speed. Steam economy demands a final compression pressure not far below the initial pressure. Compression is useful in cushioning the reciprocating weights, and in filling the cylinder clearance area. All the energy expended in compression is given back on the new stroke, less frictional losses.

Typical Examples of Good Practice in Proportioning Exhaust Clearance to Steam Lap

Lead	Steam lap	Exhaust clearance	Exhaust opening, end of stroke
¼ in.	1 in.	¼ in.	1½ in.
¼ in.	1¼ in.	⅛ in.	1⅝ in.
¼ in.	1½ in.	1/16 in.	1 13/16 in.
¼ in.	1¾ in.	0	2 in.
¼ in.	2 in.	1/16 in. Neg.*	2 3/16 in.
¼ in.	2½ in.	⅛ in. Neg.	2⅝ in.

* Negative exhaust clearance (exhaust lap).

Exhaust Opening.—Steam lap largely determines the width of the exhaust opening at the end of the stroke, and also the maximum exhaust opening.

The width of the exhaust opening at the end of the piston stroke is a constant for all points of cut-off. It is the steam lap plus the lead plus the exhaust clearance. The maximum exhaust opening varies with the valve travel and steamport opening, and for a given cut-off it is equal to the steam lap plus the exhaust clearance.

Valve Travel.—The valve travel at short cut-offs is also largely determined by the steam lap, for the reason that valve travel at any given point of cut-off is twice the steam lap plus twice the port opening. In mid-gear, with the reverse gear on centers, the valve travel is twice the steam lap plus twice the lead.

At this point, the valve travel is derived altogether

[3] See application on D. & R. G. W. locomotive, page 683, November, 1929, *Railway Mechanical Engineer.*

from the combination lever, and in the shorter cut-offs by far the greater part of the travel is obtained from the same source. However, with the wide steam-lap arrangement, a proportionately greater movement is required from the radius bar. For example, at 25-per cent cut-off with the coventional narrow-lap arrangement of 1-1/8-in. steam lap and ¼-in. lead, the radius bar movement is approximately ½-in., while with a 2-in. steam lap and ¼-in. lead, this movement is approximately 2¼ in. This means that, for a given point of cut-off, the reverse lever must be lower in the quadrant with wide steam lap.

Desired Running Cut-Off Is 25 Per Cent.

It was shown on the Altoona testing plant that for best economy the cut-off should not be later than 30 per cent. However, 25 per cent is the desired running cut-off, because at that point all valve events combine to produce the best economy and efficiency, and the smoothest all-around performance is obtained. With regard to overall efficiency and a view of limiting friction and wear, present valve gears should not be operated at cut-offs shorter than 20 per cent. The periods of piston stroke at which valve events occur change rapidly as the cut-off is shortened betwen 25 per cent and mid-gear, with the result that wide variations in pressures are produced throughout the stroke. At the very short cut-offs, release occurs much sooner in the cycle, and compression pressure is extremely high, due to a much earlier closure and greater pre-admission. It has been shown by actual service tests that compression pressure may build up several hundred pounds higher than boiler pressure when a large-cylindered locomotive is operated at extremely short cut-offs.

Valve Setting.—Effective valve setting is a matter of obtaining the best possible distribution of steam from a given design and arrangement of valve and valve gear. The cost of securing efficient steam distribution is out of all proportion to the gain in smooth-working conditions, fuel and water economy, and reduced running-gear maintenance, resulting from the improved condition. The piston thrust on recently-designed locomotives is exceptionally high, and careful valve setting is necessary in order to obtain good equalization of power; otherwise, severe stresses are set up in the running gear.

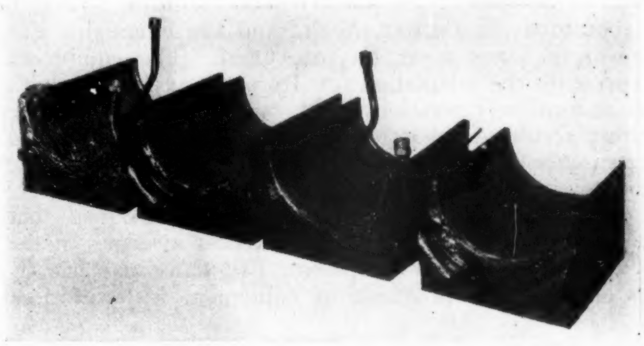
The setting of a well-designed valve gear is comparatively simple, because a close equalization of lead causes approximate uniformity of all events. While a close equalization of lead is not of vital importance, as it affects distribution, it is by far the best basis upon which to set valves.

In the long cut-offs, which are only used at slow speeds, square port openings are not essential to good distribution of power, provided the cut-offs are well equalized. However, at the shorter cut-offs, which are used at high speed, a close equalization of port openings is equally as important as square cut-offs. The end and aim should be to obtain the best possible equalization of valve events in the 25-per cent cut-off position. This can usually be accomplished by equalizing the port openings and cut-offs after a preliminary adjustment of the lead.

Love Will Find a Way—Arthur Whipkey of Uniontown, Pa., is ready to testify now that the course of true love never runs smooth. Arthur had a "date" with his girl recently and, perhaps for the purpose of making an impression, he decided to drive over to her house in a locomotive. The enginehouse forces of the Baltimore & Ohio at Uniontown finally convinced him that stealing a locomotive is not quite the thing to do, but not until after Arthur had derailed one engine and made valiant efforts to remove another from the enginehouse.

Pneumatic Lubricator For Engine-Truck Journals

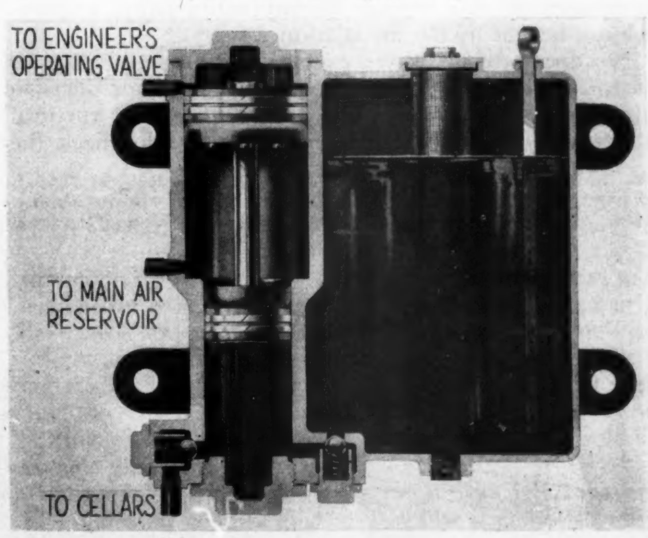
Because of the relative inaccessibility of engine-truck journal boxes, as well as the unusually severe service encountered by these journal bearings, the question of proper lubrication has long been a serious one, intensified in recent years by the general extension of locomotive runs. As a means of overcoming difficulties with engine-truck lubrication, the Christy pneumatic lubricator has been developed and applied to over 60 mountain-type locomotives on the Illinois Central. This lubricator, now supplied by the Locomotive Firebox Company, Chicago, is also adaptable for the lubrication of trailer-truck and tender-truck journals, providing a ready means for forcing oil under pressure into the standard waste-packed journal box at predetermined intervals by the manual operation of a simple air-control valve in the cab. The lubricator works whether the locomotive is standing or operating at high speed and may be used to supply normal lubrication, or to permit bringing a train in, when an emergency such as a hot box develops, without delay, cut journals or the possibility of bearings being damaged by the application of water.



Unglazed condition of the packing in four truck boxes after 10,033 miles

The Christy lubricator is simple in design and contains no complicated mechanism subject to excessive maintenance or failures. It consists of an oil reservoir or container in conjunction with a cylinder containing a floating piston which, under air pressure, moves upward to draw oil by vacuum into the lower portion of the cylinder and again by air pressure is forced sharply

(*Concluded on page 16*)



The air-cylinder and oil-reservoir arrangement of the Christy lubricator

Frigidaire Builds Air-Conditioning Equipment

Standard units designed for installation in existing equipment weigh only 2,405 lb.

FOR more than a year past the Frigidaire Corporation, Dayton, Ohio, refrigeration subsidiary of General Motors, has been engaged in research and experimental work on light-weight air-conditioning equipment built into existing railroad rolling stock and as a result of this work has developed a unit weighing only 2,405 lb., exclusive of generators and batteries, with sufficient refrigeration capacity to meet the maximum demands for service on coaches, dining cars, club, observation and sleeping cars. The new Frigidaire equipment is a joint development of the General Motors Research Laboratories at Detroit, Mich., and the Frigidaire Engineering Division at Dayton, Ohio. The equipment represents the adaptation of 16 years experience with mechanical refrigeration to the railroad field and is the direct result of laboratory research and actual service experience on test cars operated in all parts of the country during the past summer months.

The air-conditioning equipment is so designed that it may be used as a duct or a ductless system. In the development of this equipment, Frigidaire has had as its objective the provision of equipment with sufficient

One of the cooling coils

flexibility that it is possible to use standard units for all types of cars from coaches with large carrying capacity to compartment sleepers which carry only a dozen or more persons. The equipment is of such type that installations will be made in the regular shops of railroad companies so that regular railway maintenance employees can benefit by the installation work.

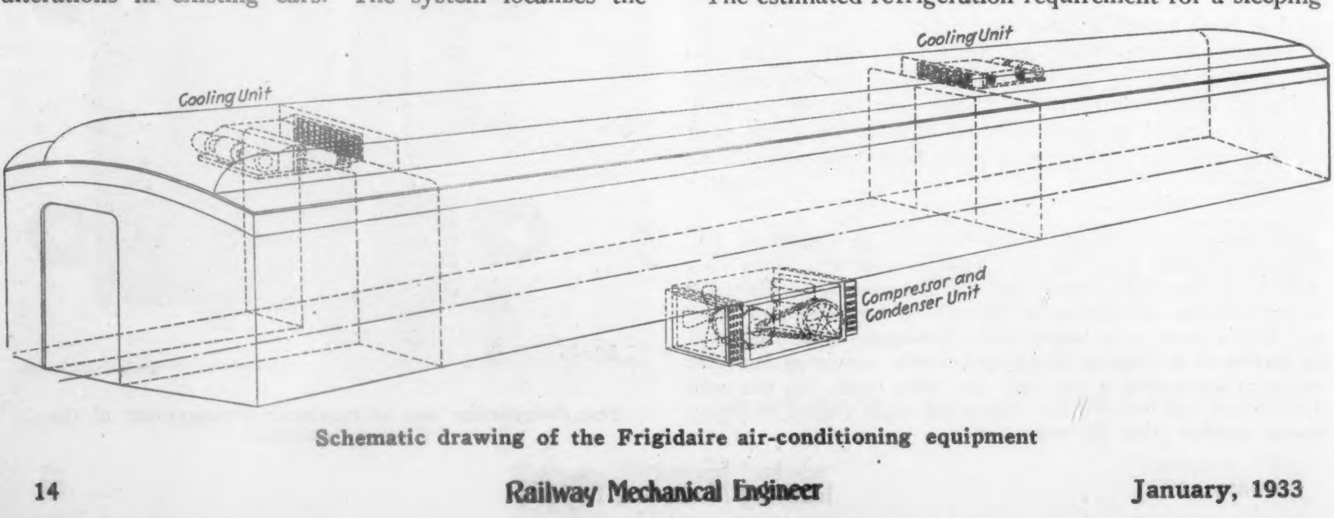
No ducts are necessary except in the case of all-compartment cars. The elimination of the need for ducts in turn eliminates the necessity for expensive structural alterations in existing cars. The system localizes the cooling effect in each section so that odors and smoke from one section are not drawn through the entire car. However, the cooling coils are designed in such a way that they are applicable either to the duct or the ductless system, depending upon which may be desired by the individual railroad.

The mechanical unit consists of a four-cylinder compressor producing five tons of refrigeration when driven by a 7½-hp. motor and seven tons when a 10-hp. motor is employed. The mechanical unit is enclosed in an oblong shape housing designed for suspension beneath the car underframe. Both compressor and motor are readily accessible for routine checking. By suspending the compressor unit beneath the car, the necessity for permanently blocking vestibules is eliminated. The Frigidaire air-conditioning system utilizes the refrigerant Freon or F-12 developed by the Frigidaire laboratories and manufactured by Kinetic Chemicals, Inc., a subsidiary of E. I. duPont de Nemours & Co. The refrigerant is carried from the compressor underneath the car to coils installed in the bulkheads by small refrigerant lines that are invisibly and easily installed without alteration of the car structure.

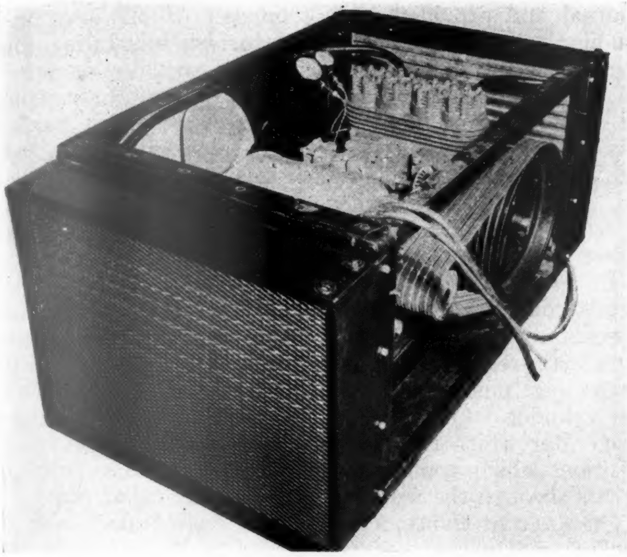
In the case of a standard sleeping car of 10 sections, one drawing room and two compartments, the manufacturers of this equipment recommend two large coils for installation in the bulkheads at the ends of the main section of the car and smaller coils for the drawing room and compartments, and dressing rooms. Fans beneath the coils force the air through the cooling coils and grilles that deflect the conditioned air in the proper direction.

Provision is made for the introduction of new air to be mixed with the recirculated air. Excess humidity is reduced by condensing moisture as the air passes through the cooling coils. Road tests have indicated that this method produced no objectionable draft at any point in the car and that comfortable conditions can be maintained in the berth whether the train is stationary or in motion.

The estimated refrigeration requirement for a sleeping



Schematic drawing of the Frigidaire air-conditioning equipment



The compressor and condenser is a compact unit designed for suspension beneath the car underframe

car operating under maximum heat and humidity conditions is five tons and the same amount of refrigeration is required for a diner with a seating capacity of 36 passengers and a crew of six. In the case of diners, the kitchen is not air-conditioned mechanically, but a curtain of cool air between the kitchen and the dining room is maintained of sufficient magnitude effectively to prevent any infiltration of food odors from the kitchen. This method is said not only to provide a barrier to air flow between the dining space and the kitchen but also helps to cool the kitchen to a temperature several degrees below that normally experienced.

Modern day coaches with a passenger capacity of 70 to 80 persons are estimated to require approximately seven tons of refrigeration under maximum conditions and the Frigidaire compressor unit is designed with sufficient capacity to meet these requirements. The air-conditioning equipment is supplied by the manufacturer ready for installation by the railroads in their own shops and by their own employees. Since all the equipment is standard, mechanical units and coils are interchangeable, making it possible to keep replacement stocks at shops at a minimum.

A Pullman installation in a small compartment

All cars using this equipment will be equipped with thermostatic control, making it possible for the equipment to function properly on runs on which cars go from one extreme of temperature to another.

In anticipation of the desire of passengers for the addition of moisture in the winter time and for light heating in the fall and the spring, when it is not desirable to use the ordinary steam heating of the car, the coil and fan assemblies are so designed that a small heating coil and a steam jet may be installed and the air circulated by the regular blowers. It is claimed that the control of humidification by this equipment will overcome the abnormally dry indoor atmospheric conditions and will, at the same time, lower the steam requirements for heating.

Preliminary Research and Tests

During the past month a Pennsylvania Railroad dining car, No. 7956, was taken off its regular run between New York and Washington after about 27,000 miles of

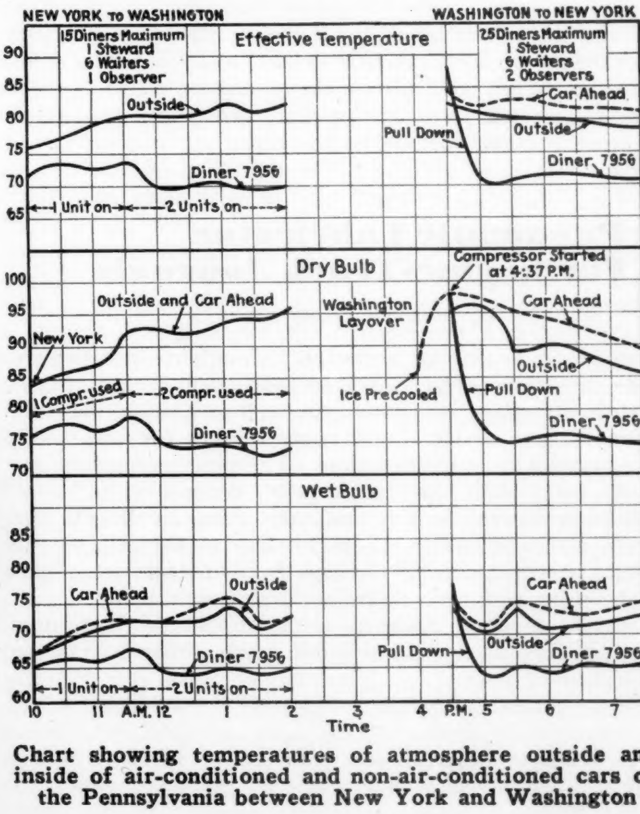


Chart showing temperatures of atmosphere outside and inside of air-conditioned and non-air-conditioned cars on the Pennsylvania between New York and Washington

service. This diner has been in use for some time as a test car on which engineers of the Frigidaire laboratories have been experimenting with the possibilities of lightweight air conditioning equipment built into existing rolling stock. The car was completely air conditioned without any changes to its construction other than minor cutting of the bulkheads since no additional insulation and no ducts were used.

The equipment used on this car differs from the new Frigidaire air-conditioning unit in that it consists of two 2½-ton capacity Frigidaire compressors placed in the steward's linen closet and air-cooled condensers with

separate motor-driven fans slung beneath the car underframe in line with the battery box. Two cooling coils are placed behind the bulkhead partitions at either end of the car. Outlet grilles are provided for the cool air ahead of each coil and return grilles at the rear of each coil for recirculated air. Multivane blowers send the air through the blowers and a regulated amount of fresh air is drawn through filters by the main blowers. It is said that although the car was in daily use and the equipment functioned day after day under summer heat and humidity, the original charge of the refrigerant, Freon, or F-12 has not been replenished. The car travelled approximately 27,000 miles in service with no other attention given it than normal routine inspection.

The power for the operation of the two compressors used in the experimental equipment in this dining car is supplied by a 15-k.w. axle generator in conjunction with an 800-amp.-hr. storage battery. The electrical lines to the compressors are carried from the battery box through a single conduit. The energy stored by the batteries is sufficient for the operation of the air-conditioning equipment before the train starts and at times when the train is standing in the station, insuring the maintenance of comfortable conditions whether the train is in motion or not. The motors operating this experimental equipment in this diner are rated at 5 hp. each and operate on 32-volt direct current.

The new unit type equipment described in the first part of this article is the direct result of the experimental work done on Pennsylvania diner No. 7956. It is compact in design and all of the operating parts, except the refrigerant lines and cooling coils, are suspended beneath the underframe of the car.

Pneumatic Lubricator For Engine-Truck Journals

(*Continued from page 13*)

downward to discharge the oil through tubing directly into the truck-cellar packing and to the hub plate. Truck hub-plate lubrication, as well as journal lubrication, is thus under direct control from the cab while the locomotive is in operation. The pipe connections include one ¼-in. air line to the control valve, conveniently located in the cab, one ¼-in. air line to the main reservoir and a ⅜-in. oil line to the cellars, the final connections being through flexible tubing to a special fitting and pipe extension from each cellar.

Inside of each cellar is a perforated oil-distributor pipe, located as high as possible in the cellar behind the journal and provided with a number of oil holes, including one hole in the end to furnish lubrication for the hub plate. The lubricator itself, usually mounted on the front of the cylinder casting, has an oil reservoir of sufficient capacity for long runs. Standard truck box cellars are used, to which the pipe with graduated perforations is applied in each cellar for spreading the oil. Chokes are used when required to assure an equal distribution of oil to all cellars. Cellars are packed with waste in the usual manner.

In operating the lubricator, the handle on the engineer's control valve is turned to operating position to exhaust air from the top of the cylinder. This permits main-reservoir pressure to raise the piston which draws one pint of oil into the lower or small end of the cylinder. One minute is required for this operation, after which the handle is then returned to normal position, which applies air to the upper piston, forcing the oil through the manifold and into the cellar pipes.

On a recent endurance test, four engine-truck cellars packed with spring packing, sealed to prevent tampering and oiled exclusively by the Christy lubricator, ran 10,033 miles, after which the bearing surfaces of the spring packing were fresh and unglazed, and no surplus oil was present in the packing or in the bottoms of the cellars. Experience on the Illinois Central indicates that prior to the use of this device on certain locomotives it was frequently necessary to repack oil cellars every few hundred miles at intermediate points, and that many delays, formerly occasioned en route by the necessity of hand-oiling hot boxes, are now eliminated.

Locomotive Stoker Of Small Capacity

THE Standard Stoker Company, Inc., 332 South Michigan avenue, Chicago, to meet a demand for a stoker of smaller capacity than the present designs, has built one of rugged, simple construction.

Distribution of the fuel over the grate area is controlled by the fireman from manually operated jet valves, which are contained in a manifold located in a convenient place on the back head of the boiler. Numerous tests have been conducted with different kinds and grades of coal to obtain the best and most flexible distribution of coal.

One of the illustrations shows a general view of the stoker which, in appearance, is similar to the present Type BK or back head design. A feature of this design is the location of the automatic fire door, which is

General arrangement of the Christy lubricator as applied for lubricating locomotive engine-truck, trailer, or tender-truck journals

on the rear of the stoker discharge box, requiring a minimum opening in the back head of the boiler.

The design of the tender trough is simple. The front of the tender trough, support and tender bowl are cast integral. The rear of the trough and the gear housing are also in one piece. Both these parts are made of cast steel. The steel plate (trough proper) is riveted to the end castings. This design of trough reduces maintenance cost, as no fabrication is required. The only wearing piece in the trough proper is a steel plate.

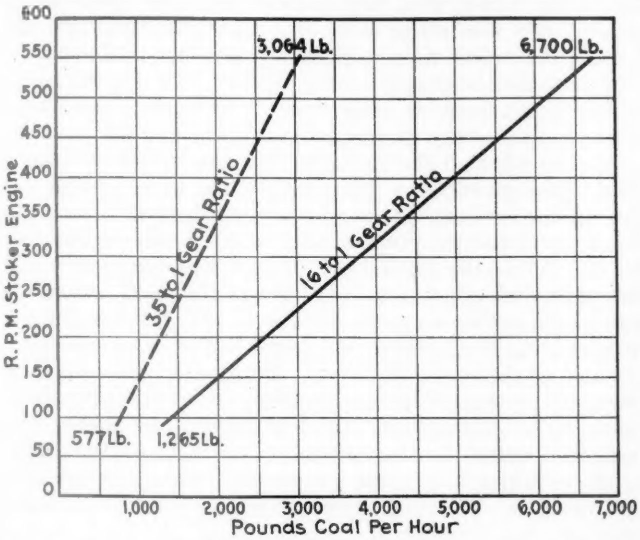
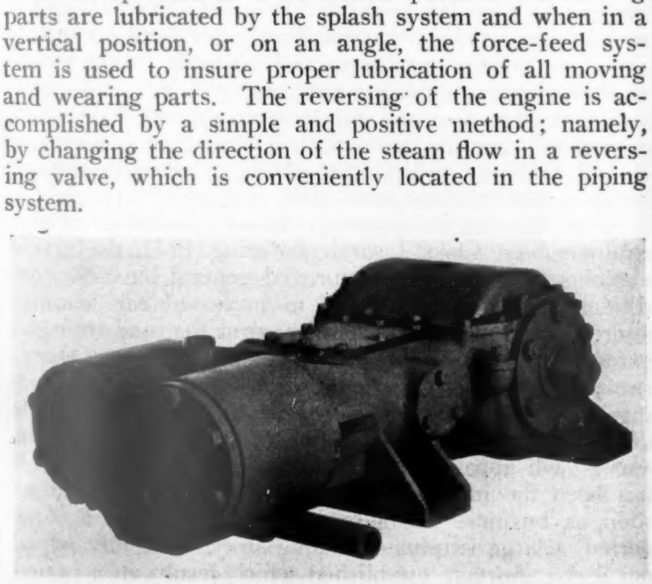


Chart showing the capacity ranges of the standard small-capacity stoker

While the illustration shows the back-head type of stoker, the manufacturers will furnish a type discharging coal inside of the firebox, or similar to their present modified Type B.

The new stoker is driven by a 5-in. by 5-in. two-cylinder, double acting, medium-speed, reciprocating engine. This engine was designed to operate in both directions; that is, over and under, in either a horizontal or vertical position, and to deliver power from either end of the crankshaft. Therefore, the engine can be located in any desired position on either the left or right side of the locomotive or tender. The engine is completely inclosed, protecting all working parts.

When operated in a horizontal position the moving parts are lubricated by the splash system and when in a vertical position, or on an angle, the force-feed system is used to insure proper lubrication of all moving and wearing parts. The reversing of the engine is accomplished by a simple and positive method; namely, by changing the direction of the steam flow in a reversing valve, which is conveniently located in the piping system.



View of the stoker engine from the front or cylinder end

The minimum capacity of the stoker is approximately 575 lb. and the maximum capacity approximately 6,700 lb. of coal per hour. The chart shows the range of capacities for this stoker. The solid line shows the capacity with a 16 to 1 gear ratio, the minimum being 1,265 lb. of coal per hour at 90 r.p.m. of the stoker engine and 6,700 lb. at 550 r.p.m. The capacity with a 35 to 1 gear ratio, is shown in dotted line, the minimum being 577 lb. of coal per hour at 90 r.p.m. of the stoker engine and a maximum capacity of 3,064 lb. of coal per hour at 550 r.p.m. Range capacities between the gear ratios mentioned can be obtained by gear changes in the housing at the rear of the tender trough.

One Hundred Years Ago This Month

January 5, 1833.—"The cut at the head of the Journal represents the *American Locomotive Engine,* PHILADELPHIA, built at the Westpoint Foundry Works in this city [New York] for the Philadelphia, Norristown and Germantown Railroad, with a freight car, passenger coach, and private carriage attached, by way of showing the advantages and facilities which may be enjoyed by the inhabitants living in the vicinity of Railroads." [A reproduction of the cut to which this item by the editor refers was published in the October, 1932, issue of the *Railway Mechanical Engineer,* page 389.—Editor.]

January 12, 1833.—This issue of the Journal contains a description of an invention by G. V. Borch of St. Croix of an electrical telegraph which he thought might be applied with great ease to long lines of railroad. In his letter to the editor Mr. Borch states: "On the principle that the electric fluid can, by means of an insulated conductor, be conveyed to any distance instantaneously, and that where there is any small opening in the conductor a spark will appear, which principle has been proved or established by numberless experiments, I have discovered a mode by which an instantaneous and reciprocal communicator of any intelligence from one place to another, at any distance, may be made."

January 19, 1833.—This issue contains a discussion by "V. D. G." of the Lexington & Ohio Railroad of the performance of certain locomotive engines moving with different loads and upon planes of different inclinations which were described in the book "The Treatise on Railroads," written by Nicholas Wood. In stating his case, the writer points out that the principal difficulty in estimating the performance of these engines is the uncertainty which seems to exist with respect to the amount of the loss of leverage under which the pressure of the steam in the cylinders must act in communicating motion to the traveling or adhesion wheels. For with respect to steam engines in general, a great source of loss in power arises from the oblique action of the connecting rods in communicating a rotary motion to the crank. The writer claimed that the effective force upon the crank, during each complete revolution, abstracting from inertia and friction, is equivalent to a constant and uniform pressure of very nearly two-thirds of the whole force of the steam upon the piston rods, acting at the extremity of the crank, in the direction of its motion.

January 26, 1833.—A writer, who signed himself "Publicola," advocates a system of foot railroads over which a man can move a load of 29 cwt., or more than two horses could draw on a common road at four miles and more than a yoke of oxen could draw at two miles an hour.

EDITORIALS

Reduced Locomotive Failures

Under the urge for economy in 1932 maintenance expenditures on the part of steam railroads were cut to the bone, but every indication points to the fact that the mechanical condition of locomotives kept in service has been maintained at a generally high standard. The percentage of locomotives inspected and found defective, as reported by the Bureau of Locomotive Inspection, for example, has shown a consistent decrease from 65 per cent in 1923 to 10 per cent in 1931 and 8 per cent in 1932.

The number of train delays caused by locomotive failures is also an excellent criterion of maintenance standards, and, on many roads, the number of locomotive failures on both a time and mileage basis has not only failed to increase as might be expected from such drastic reductions in maintenance expenditures but has actually decreased. On a typical midwestern carrier, for instance, the performance in the first 10 months of 1932 was such as to indicate an average number of miles per failure for the year of 161,198, as compared with 160,251 in 1931 and 35,182 in 1924. Reduction in engine failures is an important, if not a conclusive, test of the excellence of maintenance practices.

The maintenance of pipes, pipe connections and clamping devices is an important factor in locomotive failures. One railroad, as pointed out in the article, "Locomotive Pipe Clamping," published elsewhere in this issue, practically eliminated locomotive failures due to pipe defects by developing an improved standard piping installation and clamping arrangement which was a great improvement in this particular detail of locomotive construction. Failures caused by broken pipes at such important points as the power reverse gear, brake valve, distributing valve, etc., were eliminated, and the improved standard piping practices adopted not only reduced failures but cut shop expense by facilitating the removal and reapplication of pipes at general shoppings.

Technocracy—Another Fad?

Under the guise of engineers and scientists a group of men at Columbia University have in recent weeks thrown quite a scare into the American public. We look to engineers for facts and constructive efforts. The Technocrats, who are apparently not a part of Columbia University, but are housed in its engineering department, and at least partially financed by the Architects' Emergency Committee, have dramatically presented certain facts about the growth and development of industry. While some of the data presented obviously need rechecking, no one questions but what our mass production methods have greatly complicated matters in this country and that we must carefully study industrial and economic conditions in order to find ways and means of balancing and stabilizing economic forces.

There is no warrant, however, at least on an engineering basis, for certain suggestions that are being spread broadcast, to the effect that our entire social and economic arrangements must be radically changed if we are to avert disaster. Ordinarily extreme reports of this sort are discounted, but unfortunately, in this case, the fact that they came from a group associated in some way with Columbia University, and also because they were given out by men who claim to be engineers and scientists, has caused the public to take them too seriously. The situation has also been aggravated by the fact that so many of the magazines, as well as the newspapers, have carried reports of the doings of the Technocrats.

We do need all the facts that we can get about industrial development and the effect of the mass production era upon economic, social and political forces. The task, however, must be gone about on a sound engineering basis. After the facts have been fully ascertained and substantiated, they must be given thorough scientific consideration by experts on all of the various factors involved in the economic and social life of our own country and of the world at large. Because of the complications of modern life, the problem of integrating these facts and devising ways and means of balancing the economic forces is stupendous. It will, however, have to be performed by some group or groups that are less interested in dramatic presentations and loose publicity than are the Technocrats.

It is doubtful if any greater service can be rendered to humanity at this time than by promoting economic research, with a view to balancing the forces of production, distribution and consumption. The Twentieth Century Fund in its report for the year 1931, shows that 102 major foundations interested in social service work used less than two per cent of their appropriations for that year in the study of economics and the causes which lie behind our present economic distress. The total grants for that year amounted to $54,600,000, but only $824,000 was used for economic research.

The Prospects for New Equipment

Under the title "Brighter Outlook in Railroad Supply Field," the January issue of "The Rail," official publication of the Chesapeake & Ohio and Pere Marquette, presents an article with some highly pertinent comments regarding present conditions and probable future trends in the railway equipment and supply field. With railway orders so few and far between during 1932, these comments, carrying an optimistic note and pointing to the silver lining behind the clouds of present reduced business activity, are more than welcome.

After showing the greatly reduced installation of new equipment on Class I carriers during 1932, the article explains that somewhat improved general business conditions are already reflected in increased car loadings and railway revenue which will permit the roads to make greater expenditures for maintenance and for new equipment. It is a fact that the spread between the car-loading curves for 1932 and for 1931 has showed a steady decrease from July to date and at the present rate the curves will apparently cross some time in January. It has been the invariable experience in the past that as soon as business starts to improve following a slack period, a large surplus of rolling stock is rapidly wiped out and a shortage established which results in a period of good business for the supply companies.

Commenting on the present condition of railway equipment as regards depreciation and obsolescence, "The Index," published by the New York Trust Company, is quoted as saying: "Our railroads, today, must meet the speedy delivery of the truck at distant points. This means scheduled freight trains making average passenger train speeds, which, in turn, makes obsolete many of the reserve locomotives now classed as available for service. True, many of these reserve locomotives can make these necessary speeds with restricted train loads, but the maintenance cost of this equipment under these new conditions would be unduly high.

"Likewise, many idle freight cars stored, as in good order, will not perform the service which their numbers would indicate. The high scheduled speeds of the present-day freight train and other modern traffic demands will make it increasingly difficult to maintain in general service the more than 800,000 freight cars over 20 years old. The cost of repair and maintenance of these cars, many with obsolete parts, is often greater than that involved in the purchase of new cars. For instance, the American Railway Association recently estimated that no less than 500,000 freight cars will have been scrapped by 1936."

Cheerful news to the equipment field is also contained in the fact that, in addition to the depreciation and obsolescence in idle rolling stock, a considerable amount of this equipment is being gradually drawn back into service. The low point for surplus freight cars in 1932 occurred on October 31 when only 545,167 cars were reported stored in good service and, while this figure increased somewhat in November and December, due to the seasonal drop in car loadings over the holidays, the number of surplus cars shows a noticeable tendency to decrease, which is another reason for encouragement.

The Task Grows Harder

Mechanical-department supervisors who have been responsible for the maintenance of locomotives during the past two years have been subjected to pressure and required to get results under conditions which three years ago would have been considered impossible. In imposing these conditions managements have had no choice, but nevertheless they owe a debt of gratitude to the men who have kept sufficient motive power operating with inadequate labor and even more inadequate supplies of materials. That the job has so far been done successfully is indicated by the continued improvement in locomotive conditions shown by the report of the chief inspector of the Bureau of Locomotive Inspection for the fiscal year ended June 30, 1932.

Since the beginning of 1930 there has been a steady decline in the amount of labor expended on the restoration of locomotives—a decline which has been at a considerably greater rate than the decline in locomotive mileage. During the late summer and early fall months this had reached a point where not more than three-fourths of the mileage actually being run out was being restored by repairs. The cumulative effect of this growing proportion of deferred locomotive maintenance is seen in the number of locomotives undergoing or awaiting repairs which increased from 4,000 in September, 1929, to 8,400 in September, 1932, and over 9,000 two months later.

Despite this increase in the number of unserviceable locomotives, the locomotive mileage had been declining at a rate such that there had been a steady increase in the number of locomotives reported as stored serviceable during the past three years. From a number which varied between 4,000 and 6,000 during 1929, the number of stored locomotives cumulatively increased to over 11,600 during July and August, 1932.

Based on a comparison of the purchases during 1928 and 1929, it is evident that the supply of materials has not been sufficient during the past two years even to provide the material required by the amount of work actually performed. Like the amount of work itself, this deficiency is becoming progressively larger. For 1932 as a whole, new materials have not been supplied in amount adequate to restore more than half of the locomotive mileage which has actually been run out. For the year as a whole not more than 80 per cent of the miles run out have been restored by maintenance—a fact which strongly points to the conclusion that for about one-third of the work actually done the necessary material could only have been secured by robbing power reported as stored serviceable or awaiting shops. The cumulative effect of this material shortage has been such during the past two years as to raise a grave question as to the serviceability of a very large proportion of the locomotives supposed to be stored serviceable.

So long as the volume of traffic continued to decline, such a situation might itself be continued, if not indefinitely, at least for many months. With a halt in the decline in traffic, however, even though there be no immediate marked increase, the situation has reached a point where the margin of reserve will disappear with great rapidity. Even with declining traffic, motive-power-department supervisors have had to do fast work to keep from paying the piper. With a steady increase in traffic, even though slight, the bill will have to be paid.

An Appeal to The Public

Regardless of the economic depression which has so seriously affected all industries, the railroads, because of excessive regulation and subsidized competition, have been seriously handicapped, even under normal conditions.

American industrial leaders are making a determined fight to bring business back to more normal and stable conditions. The National Committee on Industrial Rehabilitation, headed up by A. W. Robertson of the Westinghouse Electric & Manufacturing Company, has perfected a strong organization throughout the nation. Industries whose credit is such that they can now finance improvements which will be needed when conditions become more normal, are urged to do so at this time, when the work can be done at low unit prices and without interfering with production. This campaign is being carried on aggressively and effectively.

Railroads Large Purchasers

The railroads are large purchasers. In the five years previous to 1930 railway purchases averaged well over two billion dollars a year. In the past three years they have fallen off very nearly one billion dollars a year.

There are many ways in which the railway plant can be so improved that it will function more efficiently and more economically. Unfortunately, the credit of the railways is such that they can now finance very few of these improvements, except for such assistance as is extended to them by the Reconstruction Finance Corporation. Aid has been given by this Corporation to such projects as the Pennsylvania Railroad electrifica-

tion and the New York Central West Side improvements in New York City. Moreover, it has advanced funds to several roads with which to build new equipment or make heavy repairs to cars and locomotives. This is hardly more than scratching the surface, however, and real and substantial progress cannot be made until investors are assured that the railroads will be given a real opportunity to stage a "comeback."

While the railroads are naturally greatly interested in the excellent work which is being done by the National Committee on Industrial Rehabilitation, they cannot play a large part in that program until their credit is greatly strengthened. How can this be done?

The Associated Business Papers, Inc., recently awarded the Railway Age the first prize for the best article or series of articles published during the year 1931. This was for the series of 25 articles on planning for railway economy, published during the latter half of that year. These articles clearly indicated the improvements which should be made to insure more economical and efficient operation. What is now needed is ways and means for financing such improvements. Obviously the money cannot be obtained unless the investing public is fully assured of the future prosperity of the railways.

Pointing the Way

The Railway Age has again rendered a remarkable service in pointing the way. With the help of the railway supply manufacturers and the railroads, a special issue was published on December 3, 1932, which was directed particularly to the legislators, the regulating authorities and the public. Clearly, and as concisely as possible, considering the immensity of the task, this special number explained the importance of the railroads to the nation, outlined the present railway situation and its causes, and then pointed out what the railroads are doing to help themselves and what the public must do to foster the railroads in its interest.

No sane man in this day questions the advisability of a certain amount of regulation of common carriers, but clearly the railroads have been over-regulated. The Railway Age advocates a retroactive repeal of the recapture clause and the repeal of the Valuation Act of 1913. It points out that rate adjustments should be made more flexible and that the suspension power of the Interstate Commerce Commission should be withdrawn. It insists that the railroads should be allowed to engage in water transport and urges that all types of common carriers—rail, waterway, highway and airway—should be subjected to similar regulation.

Other types of common and contract carriers, subsidized at the taxpayers' expense, are seriously endangering the railroads—the backbone of American transport. The railroads must furnish and maintain their own right-of-way and pay heavy taxes on it, such taxes being used for carrying on all sorts of governmental activities. Other competing carriers operate on rights-of-way furnished and maintained by the taxpayer and such taxes as they do pay do not begin to offset the expense to which the public is put, let alone contribute anything toward the support of other governmental activities.

The special issue of the Railway Age is unique in that the advertisers—the railways and the railway supply interests—in many instances utilize their space to tell how they are being affected and what steps should be taken to overcome the difficulties in which the railways find themselves. It is doubtful if any other business publication has ever undertaken so important an assignment in its own field, or in the public interest, or has carried it forward in such a unique manner. We are proud indeed of our associate, the Railway Age.

NEW BOOKS

PROCEEDINGS OF THE INTERNATIONAL RAILWAY FUEL ASSOCIATION.—*T. Duff-Smith, secretary-treasurer, International Railway Fuel Association, 1660 Old Colony Building, Chicago. 171 pages, illustrated. Price, $3.*

While it was unanimously decided by the members of the Executive Committee of the International Railway Fuel Association to eliminate the 1931 convention, the twenty-third annual book of proceedings has been compiled in order that the progressive work of the association in the interest of fuel economy might be continued. The 1931 proceedings include addresses by President C. H. Dyson, fuel agent, Baltimore & Ohio, and C. B. Huntress, executive secretary of the National Coal Association, and important papers and discussions by the regular committees. The Committees on Diesel Locomotives, Coal Fired Stationary Boilers, and Storage of Coal and Oil reported no marked changes or developments during the year and had no reports to submit. The Committee on Steam Turbine Locomotives reported practically no experimental work being done, the only article printed on this subject being one by R. P. Wagner, superintendent, Locomotive Department, German State Railways, in the September, 1931, issue of the *Railway Mechanical Engineer*. Only three steam turbine locomotives were found to be giving satisfactory service; one each in Sweden, Germany and Argentine. The Committee on New Locomotive Economy devices limited its report to a summary of progress during the year on some of the items carried in previous reports and mentioned such new developments as have taken place since its 1930 report. The Committee on Front Ends, Grates and Ashpans summarized certain features of front-end design and practice on locomotives burning oil, its information having been secured by inquiries directed to 18 railroads operating such locomotives. In the report on the Inspection and Preparation of Fuel, the committee has endeavored to avoid repetition of data given in previous reports which emphasized the necessity of good preparation, particularly with respect to the cleaning of coal, and various methods of cleaning and inspection. The report of the Committee on Oil-Fired Stationary Power Plants, while covering to some extent all types of boiler settings, is more confined to the settings of boilers as are generally installed in the average railway terminal plant. The Committee on Fuel Conservation Bulletins and Cartoons bases its report upon a discussion of *Action* in advertising to stimulate the will to act in the individual officer and employee. The Coal Locomotive Firing Practice report is a review of what has been said and written on coal firing practice during the past year. The Committee on Fuel Oil Locomotive Firing Practice presents a report comparable with those of previous years and covers the development of new ideas since the last convention. The Fuel Conservation Committee gives thought to the steps necessary for continued progress, emphasizing co-operation not only between engineman and fireman, but also between all departments and the entire personnel of each department, from the president of the railway and on down the line to the crossing watchman, as the keynote of fuel conservation. The report of the Committee on Fuel Distribution and statistics is a brief resume of the pounds of coal consumed per thousand gross ton-miles of freight handled on Class I railroads of North America from 1924 to 1930, inclusive. The Committee on Locomotive Fuel Stations, makes no report, but recommends for study by the committee the crushing at the mine large lumps in run-of-mine coal.

THE READER'S PAGE

A Doctor Prescribes For Brake Burns

To the Editor:

Replying to the question concerning brake burn which appeared on The Reader's Page of the November issue of the *Railway Mechanical Engineer,* if brake burn was on wheel of tender truck, I would advance the following reasons: Wheel concentrically larger than the mate wheel; brake shoe thicker than that on the mate wheel; loose bearing adjustment; excessive wear on the pedestal liner; weak truck spring allowing the brake shoe to ride the wheel tread.

If a pilot or engine truck were involved, I would add to this list the possibility of a defective centering device.

Dr. C. F. Berry.

Cotter and Split Keys

To the Editor:

With the advent of winter, car-department men, particularly those in the northern section of the United States and in Canada, are again faced with several extra worries incidental to, and to a certain extent inseparable from, cold-weather conditions. Not the least among these extra cares is trouble with foundation-brake gears, including the dropping of brake beams, largely caused by the failures of cotters and split keys in brake-hanger pins. These failures usually result in a vigorous campaign of brake maintenance. But, unfortunately, the benefit derived from such belated attention does not give immediate relief from the trouble.

The procedure necessary to insure the best results is an intensive all-year program, particularly when cars are on repair tracks, of careful inspection of all cotters and split keys, replacing those worn out or otherwise defective, and properly spreading the wings of any found incorrectly applied. Such an all-year maintenance plan, faithfully carried out by the car owners, both railroad and private line, would not only reduce the high winter brake-failure peak, but would also greatly reduce failures during the milder seasons of the year.

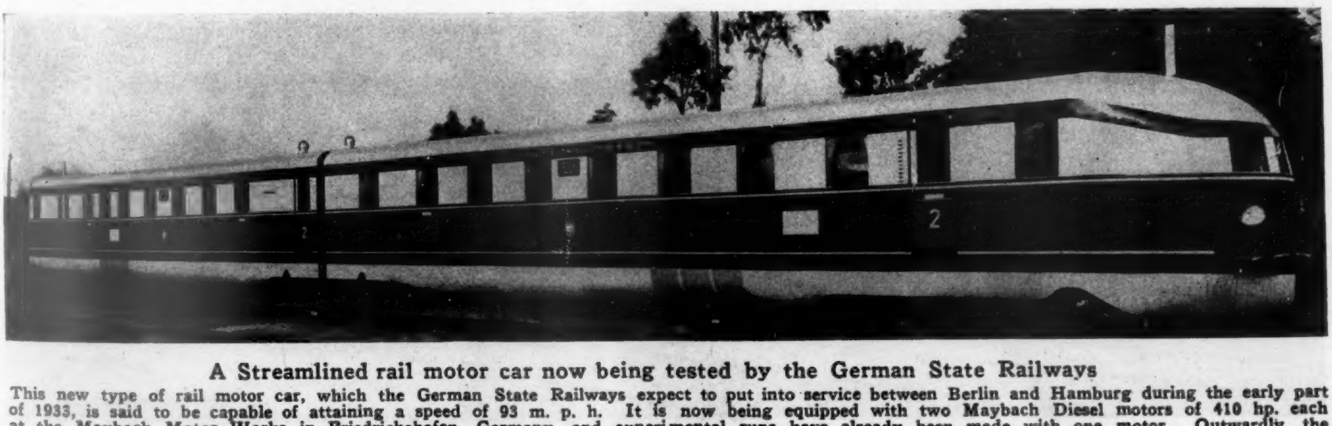
A few pointers: Cotters should be of proper size to fill the hole in the pin, and, for the conventional brake-hanger pin, not less than 3/8 in. in diameter. Keys should be only long enough to provide the necessary length of projecting ends for proper bending. The use of over-length keys should be discouraged, and such over-length keys should never be used where there is not sufficient clearance to permit the key to rotate with its pin, without the wings striking some obstruction, as that action may result in straightening out the key wings, thus leaving the key free to work out. Obviously, brake-hanger and bracket details should be so designed that a rotative straightening out of the key wings cannot take place.

It is highly important that pins be applied so that cotters and split keys may be readily inspected in train yards. On brake-hanger pins, the use of a washer back of the key is usually advisable. In splitting these keys, each wing should be spread out about 45 deg. If all the bend is on one wing, that wing may be greatly weakened, due to over-bending, and fail, with the result that the key will work out. The same danger exists when both wings of a key are over-bent. Furthermore, such keys are more difficult to remove, and if re-applied after such removal, they are likely to fail. False economy is too often practiced in the reclaiming and re-using of cotter and split keys, and their re-use is justified only when they are in first-class condition. Flat split keys made of thin, easily-bent material, should not be used in brake rigging.

Car Foreman.

Canadian National Shops and Enginehouses—Beautification work on grounds around Canadian National stations, enginehouses, shops and terminals is being continued despite economic conditions. A total of 45,000 plants have recently been distributed from the company's greenhouse at Moncton, N. B., for planting at various points along the company's property in the maritime provinces. In addition to growing plants for this purpose, greenhouses operated by the company also supply cut flowers for the dining car and hotel tables and ferns and potted plants for hotel decoration. Another gardening activity indulged in by the C. N. R. is the annual planting of thousands of fir trees along the right-of-way at various points. These take the place of snow fences, preventing drifting during winter storms and at the same time beautifying the line.

* * *



A Streamlined rail motor car now being tested by the German State Railways

This new type of rail motor car, which the German State Railways expect to put into service between Berlin and Hamburg during the early part of 1933, is said to be capable of attaining a speed of 93 m. p. h. It is now being equipped with two Maybach Diesel motors of 410 hp. each at the Maybach Motor Works in Friedrichshafen, Germany, and experimental runs have already been made with one motor. Outwardly, the new car presents an unusual appearance; projecting parts have been done away with wherever possible to reduce air pressure, running gear has been enclosed almost down to the roadbed, and the usual buffers with round, flat faces have been replaced by pointed fenders.

With the
Car Foremen and Inspectors

The Milwaukee Passenger Car Shop

*By L. B. Jenson**

PRIOR to five years ago eight shops, located at various points on the Chicago, Milwaukee, St. Paul & Pacific, repaired and repainted passenger train cars. In 1927 the passenger car repair work was concentrated at Milwaukee, Wis., and since that time the Milwaukee passenger shop has handled all of the passenger car repair work for the railroad. Concentration of work at one shop point permits a more advantageous and economical operation.

The 1,300 passenger-train cars owned by the railroad are taken into Milwaukee shop for one of three purposes. First, they may enter the shop to receive general repairs. Second, they may enter the shop to be rebuilt or modernized. Third, they may enter the shop to be given light repairs. During the period, August, 1927, to December, 1931, an average of 70 cars were repaired each month. This was a total in-and-out car movement of over five cars, or 2½ car output per working day.

The average general-repair car remains in the shop about 18 working days, a rebuilt or modernized car 55 days, a light repair car 10 days, and a new built car 40 days after receipt of the underframe from the blacksmith shop. During normal times about 44 of the 69 shop stalls are continually occupied by general-repair cars, 11 stalls by rebuilt, modernized or new built cars, three by light repair cars, and 11 are unoccupied or utilized for other purposes than to hold cars. The cars not only move through the shop at a fast speed, but they are generally "on time." A check of 2,281 cars turned out showed that only 487, or 21 per cent were "late," that is, failed for various reasons to meet their time card or scheduled-out dates.

The highest car output obtained in any one month in the history of Milwaukee shop was in August, 1927, when 103 cars, or 4 per working day, were turned out. This meant that a car costing about $1,800 for repairs left the shop every two hours of a working day. In other months the output has fluctuated from one to four cars per day, depending upon the repair program. The daily output of cars is always pre-determined, and the shop has never failed since August, 1927, to meet its output quota. The Milwaukee passenger shop in the spring of 1932, washed and painted 138 work-train cars and turned them out at the rate of one car every 77 min. 37 sec.

In addition to work on cars in its shop, the Milwaukee passenger shop manufactures, repairs and assembles a large quantity and variety of articles for use by others than itself. This material may be anything from a reclaimed angle cock to a newly made engineman's seat cushion, or from a new lamp jack to a repaired and revarnished office desk. Some idea of the quantity of the material turned out can be gained from the following facts. In 1929 the wood mill turned out 11,590,678 board ft. of finished lumber for various purposes. The pipe shop in the same year mounted 94,851 air-brake hose.

Many changes have been made in the manner of performing various work at Milwaukee shop during the past five years. A few examples will suffice to illustrate new methods or devices, some of which saved pennies and others that saved dollars.

Until a few years ago the rubber which is used to weatherstrip the sash of coaches, etc., was cut into strips from a roll of sheet rubber by hand by means of a knife and straight edge. The mill-cabinet shop installed a "home-made" machine that reduced the labor cost of cutting the strips from 7½ cents to ½ cent per sash—a 7 cents saving. In 1930 the mill-cabinet shop repaired 7,792 sash that required these rubber strips, so that the cutting machine brought $545.44 saving in that year alone.

In May, 1931, a new type of triple-valve clamp was designed and installed in the air-brake shop which eliminated six movements in the cleaning of one valve. This device reduced the cleaning cost per valve 4.8 cents.

* Superintendent passenger-car shop, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis. The accompanying article is a brief abstract of two articles published in the September and October issues of the Milwaukee Employees Magazine.

Modern passenger car on the transfer table at the Milwaukee shops of the C. M. St. P. & P.

Over 15,000 triple valves are cleaned at Milwaukee shop annually, so that the yearly saving from this device amounts to about $720.

The Milwaukee passenger shop has now a complete spraying performance for both the washing and painting of both car-bodies and their stripped parts, and is a pioneer in this aggregate spraying method, which, in normal times, results in a labor saving of from $24,000 to $30,000 per year.

This shop during the years 1927 to 1931 has shown a steady decline in the number of personal injuries received by its employes. In 1927, 74 employes were injured; in 1928, 47; 1929, 38; 1930, 14, and in 1931 only 8. Viewed from another angle, in 1927 one employe out of every 12 was injured; in 1928 one out of 17; in 1929 one out of 20; in 1930 one out of 48, and in 1931 one out of every 65. These injuries include reportable, lost time and minor. This is a good performance when consideration is given to the speed and hazard of shop operation.

Air-Brake-Cylinder Maintenance*

SINCE the brake cylinder is the center unit, around which all the other air-brake parts function, it is quite essential that the condition of the cylinder be maintained and safeguarded to a high standard. The rank and file of air-brake repair men should be familiar with the removal of the piston from the non-pressure end of the cylinder; also, how it should be well cleaned and lubricated. Owing to the importance of the brake-cylinder condition, your special attention is directed to the following:

Extreme care should be exercised when removing, cleaning or replacing the piston, that the packing cup is not damaged by excessive bending of the cup or jamming it against something while it is out of the cylinder or cutting the packing with the edge of the cylinder when replacing.

If the packing is slightly worn on one side, but otherwise in good condition, it should be turned so as to bring the worn side away from the bottom of the cylinder.

Leather vs. Composition Cups.—Leather cups have the pores filled to make them air-tight. From past experience, it has been found that this filler becomes soft in the summer months. Brake-cylinder pressure then forces out the filler, thus causing the pores to be open and leak air pressure.

Composition cups do not have pores. Expander rings are required with leather packing, while none is required with composition cups. Therefore, the composition cup appears to be the most suitable and desirable to cut maintenance cost.

Cylinder Packing-Cup Application.—Before applying a packing cup to the piston, make certain that the studs are tight in the piston. If any stud is loose, remove it, take off the nut, coat the threads of the piston end with white paint and then, using the stud nut, screw the stud solid in the piston. Apply the follower and the follower nuts, but leave the latter loose enough to carefully adjust the packing cup centrally on the piston. Tighten all of the nuts lightly; then, after making certain that the packing is still true, draw them firmly and evenly by tightening each a little at a time. The latter is to avoid cracking the follower and causing leakage.

* Abstracted from a paper entitled "Maintenance and Repairs to Air Brakes," presented by L. M. Carlton, mechanical expert, Westinghouse Air Brake Company, before the November meeting of the Car Foremen's Association of Chicago.

Even where the packing is not removed, the follower nuts should be tested with a wrench to note if any are loose and, if so, they should be tightened.

Cylinder Lubrication.—The kind of lubricant that should be used is one that does not get too stiff in winter nor too thin in summer weather. To apply it, use a brush. Apply a substantial, uniform coating to the entire inner surface of the barrel of the cylinder. Care should be used in not allowing any lubricant to get near the air intake or exit, as the exhaust action of the brake when it releases will carry this excess into the triple valve or valve mechanism. Also apply a coating of lubricant to both the inside and outside of the packing cup.

To Replace Brake-Cylinder Piston.—Seated or kneeling in the most convenient position, a little to one side (usually to the left) of the open end of the cylinder, with one leg extended, non-pressure cylinder head resting on knee, and piston facing upward, lift the piston and, still keeping its rod as nearly vertical as the release spring striking the bottom edge of cylinder will permit, enter the piston edgewise into the cylinder.

Now exerting a moderate pressure on the release spring close to the piston (alternating the hands as later indicated), press the side of the first finger against the packing close to one side of the cylinder and, at the same time, use the thumb of that hand, aided by the pressure of the other hand on the release spring, to force that side of the piston slightly inward. The side pressure on the packing must be enough to prevent its being cut or damaged by the edge of the cylinder end as the piston moves inward. Alternate this operation, reversing the hands, until the piston is entered sufficiently to prevent its packing being damaged by the edge of the cylinder end.

Next, moving the free hand to the end of the piston rod, and slipping a coil of the release spring over the bottom edge of the cylinder, as necessary, gradually force the piston into the cylinder until its top is two or three inches inside. This will require that the rod end be gradually raised, but do not raise it more than necessary.

During this time and later, do not allow the upper half of the packing to be turned back at all. A dull-edged, round-cornered scraper may be used to aid this but do not, under any circumstances, use any instrument that could cut or scratch the packing.

Next, raise the piston rod to its normal horizontal position without allowing the top of the piston to travel inward, thereby insuring against the upper side of the packing being doubled back. As the end of the rod is gradually raised, work it slightly from side to side and pull the bottom of the piston outward fast enough to prevent the top from moving inward.

When the rod is horizontal, push the piston about halfway in, then rotate the end of the rod around the center line of the cylinder at a distance of about 3 in. If the piston binds at any time while being applied, do not force it, as to do so may damage its packing. If no binding is present, push the piston to the far end of the cylinder and, after coating the bolt threads with graphite grease, rebolt the head. Draw the nuts uniformly so as to insure a full, true and firm bearing of the head against the cylinder. Re-apply and connect the push rod or cylinder lever.

The foregoing instructions may have to be varied from slightly where there is little room near the open end of the cylinder, but should be followed as closely as conditions will permit.

Loose Brake Cylinders and Reservoirs.—If the brake cylinder moves during application or release, or if any of the cylinder or reservoir bolts are loose or gone or lock nuts missing, needed repairs must be made by the brake

cleaners unless this work has been assigned to other workmen; in which case, brake cleaners will not report the brake in good order until any necessary repairs have been completed. One man can watch for movement of the brake cylinder and reservoir and their supporting brackets by bleeding off the brake. Movement of these parts causes pipe leakage and breakage.

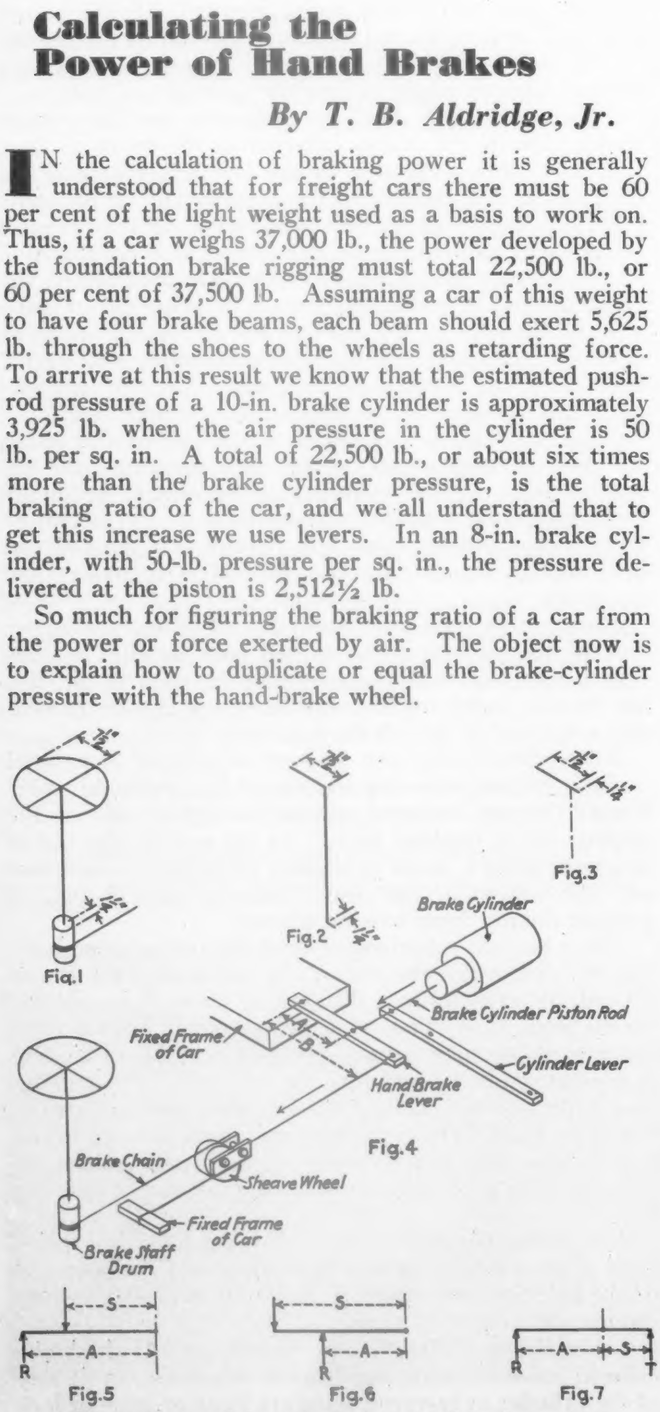
When brake cylinders and reservoirs are to be tightened on their supports, run up two or three of the nuts only sufficiently to bring the bolting flanges into light contact with the supports. Then, if the bolting flange is not in contact with the supporting brackets at each bolt, line up with cut washers where required. A failure to do this will result in springing and cracking the auxiliary reservoirs and springing the brake cylinders.

Calculating the Power of Hand Brakes

By T. B. Aldridge, Jr.

IN the calculation of braking power it is generally understood that for freight cars there must be 60 per cent of the light weight used as a basis to work on. Thus, if a car weighs 37,000 lb., the power developed by the foundation brake rigging must total 22,500 lb., or 60 per cent of 37,500 lb. Assuming a car of this weight to have four brake beams, each beam should exert 5,625 lb. through the shoes to the wheels as retarding force. To arrive at this result we know that the estimated push-rod pressure of a 10-in. brake cylinder is approximately 3,925 lb. when the air pressure in the cylinder is 50 lb. per sq. in. A total of 22,500 lb., or about six times more than the brake cylinder pressure, is the total braking ratio of the car, and we all understand that to get this increase we use levers. In an 8-in. brake cylinder, with 50-lb. pressure per sq. in., the pressure delivered at the piston is 2,512½ lb.

So much for figuring the braking ratio of a car from the power or force exerted by air. The object now is to explain how to duplicate or equal the brake-cylinder pressure with the hand-brake wheel.



Diagrams used in calculating hand-brake power

Section E, page 93, of the A.R.A. Manual of Standard and Recommended Practice states: "Based on the formulas and diagrams shown herein, the hand-brake wheel or hand-brake ratchet lever, brake staff at the chain, and the hand-brake leverage between the brake staff and the cylinder shall be so proportioned that a force of 125 lb. at the rim of the brake wheel, or 3 in. from the outer end of the hand-brake ratchet lever, will develop an equivalent load at the brake-cylinder piston of not less than 2,500 and 3,950 lb., respectively, for cars having 8-in. and 10-in. cylinders."

From the above it is understood that 125 lb. is the force that an average man will use on a hand-brake wheel. To obtain the minimum pressure required, or 2,500 lb. at the brake cylinder, it will readily be seen that it is necessary to increase 125 lb. twenty times, or 2,500 divided by 125 equals 20, and the leverage ratio must be 20 to 1.

Since it has been noted that the braking force for a car with 8-in. equipment is 2,512½ lb. when developed by air pressure and that it must not be less than 2,500 lb. when developed by hand-brake pressure (braking force and braking ratio should not be confused), let us see how this hand-brake force is developed.

Developing Hand-Brake Force

In order to clarify the explanation, Fig. 1 was made to represent the brake wheel, the drum and staff connecting the two. Fig. 2 represents the wheel and drum elements removed and levers of equal efficiency for that single position substituted. Fig. 3 represents the lower lever of Fig. 2 raised to the same level as the upper lever with the brake staff removed, as it is evident that the staff serves only to transfer the stress from the upper to the lower level by torsion and has no bearing upon the problem involved.

After reducing the problem of the brake wheel and brake-staff drum to a simple problem of levers as shown in Fig. 3, the problem becomes one of moments.

For equilibrium of forces to be arrived at in this problem, the moments of opposite forces must be equal; that is, a force of 125 lb. applied to the long arm has a moment of $7\frac{1}{2} \times 125$ (diameter of brake wheel, 15 in.; radius, 7½ in.), or 937½ in. lb., which force must be resisted by an opposite force acting through the 1¼-in. arm which is 937½ divided by 1¼, or 750 lb. applied to the brake chain.

Now, in Fig. 4, we note that the 750 lb. transmitted to the brake chain is doubled by the action of the sheave wheel to 1,500 lb. exerted at the end of the hand-brake lever.

As it has been noted that the moments of opposite forces must be equal to produce equilibrium and since both forces are known, it remains only to determine the length of arm through which these forces operate. Therefore, the moment (development) of the force of 1,500 lb. acting through lever arm *B* equals and is opposite to the moment (development) of the required force of 2,500 lb. acting through lever arm *A* from the point of connection of the chain between the hand-brake lever and the cylinder lever. Consequently, 1,500 lb. through *B* equals 2,500 lb. through *A*, or the lever arm must be three-fifths of the lever arm *B*. For example, if we assume a lever arm *B* of 20 in., then the lever arm *A* would be 12 in. and the moments of the forces would be in equilibrium; thus,

$$1{,}500 \times 20 = 30{,}000 \text{ in. lb.}$$

which figure also equals

$$2{,}500 \times 12.$$

This should be easily understood as it is apparent

from the above explanation that the calculation of the lever system from this point onto the brake shoes, with which most carmen have had some practice, is based on the equalization of forces acting in opposite directions in this same manner, and is applied by figuring the length of the lever arm through which a given force must act to produce a certain intensity.

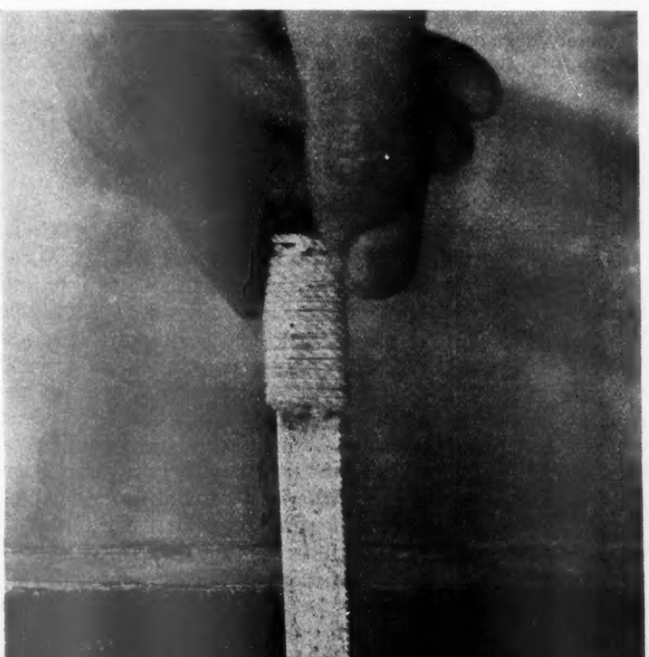
To make this even more clear, it should be remembered in making leverage calculations that the product of the delivered force and the length of lever between the delivered force and fulcrum is equal to the product of the applied force and length of lever between the applied force and fulcrum.

Figs. 5, 6 and 7 indicate three types of levers. Forces R operating through lever arm A must always equal the force T operating through the arm S to produce equilibrium.

Handy Tool for Loosening Stuck Windows

STUCK windows on caboose and passenger cars as well as shop windows are a continual problem during the winter months. When sealed by paint, ice or moisture they are an aggravation to loosen and move on occasions when they must be raised. Seldom is there a special tool about the shop with which to safely and conveniently loosen them.

To make a handy tool such as that shown in the illustration, take not over 4 in. of an old 12-in. hacksaw blade. Grind the teeth off on the sides, perfectly smooth. Also grind the break into a circular shape, sharpening it with a slow, easy taper. Wrap the pin or hole end with a number of turns of heavy cord to make a good finger grip.



This little tool made from an old hack-saw blade is handy for opening stuck windows

This tool is just thin enough, thick enough, flexible enough and yet strong enough to quickly and easily work between the window and slide. The teeth being ground off on the sides of the blade, will not scratch the finished surface; nevertheless, if necessary, it can be worked to cut away any thin film of holding ice or paint quite readily. The little tool is handy to keep or carry in the pocket.

Common Conditions Causing Hot Boxes

By P. P. Barthelemy*

This is the third instalment of a series of definitions of terms and conditions directly related to the hot-box problem. The second instalment appeared in the December, 1932, issue of the *Railway Mechanical Engineer,* page 505.

Babbitt worn through and journal running on brass—This gives a higher coefficient of friction than the babbitt and is liable to start a hot box. Bearings must not be permitted to wear through to the brass.

Second-hand bearing—Second-hand bearings must not be re-used unless the bearing face has been properly machine trued, as a bearing re-used on a journal larger than the one from which removed will surely cause trouble, as will also one with an uneven surface.

Dust guard—A poor dust guard is one that does not make a proper fit, or a dust guard that breaks easily, as a result of which possibly the first trip or so the dust guard is broken and is functioning only in part, or not at all. Dust guards should be tough to withstand breakage, should have enough spring to meet requirements, should make as nearly as possible a dust and water-proof fit around the dust guard collar and should make a tight fit over the dust guard opening in the box.

Dust guard cap missing—This is the wedge shaped cap put in the box over the dust guard. When same is missing grit, dust, and moisture work down into the box.

Journal box manufacture—Out of gage due to undetected improper manufacture. Journal boxes should be carefully gaged for all vital measurements before being accepted from the manufacturer.

Worn box—A worn roof of a box prevents free movement of the wedge. Defective lid opening prevents tight closure of the lid. Worn back end prevents proper functioning of the dust guard. Elongated bolt holes permit disalinement of the box.

Poor box lid—A lid which does not close tightly or has been damaged will permit dust, snow, water, and grit, to sift into the box. A lid should make a tight fit over the entire box opening.

Lid missing or left open—This permits sand, grit, snow and water to enter the box.

Dust guard wall worn away or broken—Permitting foreign matter to enter the box.

Wedge worn to flat surface—This restricts or prevents the normal oscillating movement between the wedge and the box, thus interfering with the alinement between the journal and the bearing.

Wedge worn or bent at front end—Permits the wedge to dislodge, thus causing uneven seating of the journal bearing.

Grit—May be due to boxes not being properly cleaned. May also be due to carelessness in the handling of journal bearings and wedges, dropping them in the dirt, or on a dirty floor, etc.

Wheels improperly mounted—That is, not equally spaced with relation to the center line of the axle.

Wheels of unequal circumference—This causes the small wheel to crowd the rail, which results in excessive collar pressure.

Wheels mounted wobbly—That is, being bored out of center, or at times diagonally, causing the wheel to wabble, which produces a pounding action on the bearing.

Wheels slid flat, shelled, comby, chill-worn spot—These four

* Assistant master car builder, Great Northern, St. Paul, Minn.

conditions cause hot boxes on account of the hammering action on the bearings.

Wheels badly tread worn—This tends to keep the wheels from shifting from side to side on the rails to meet running conditions, and causes an excessive amount of friction between the ends of the bearings and the collars of the journals.

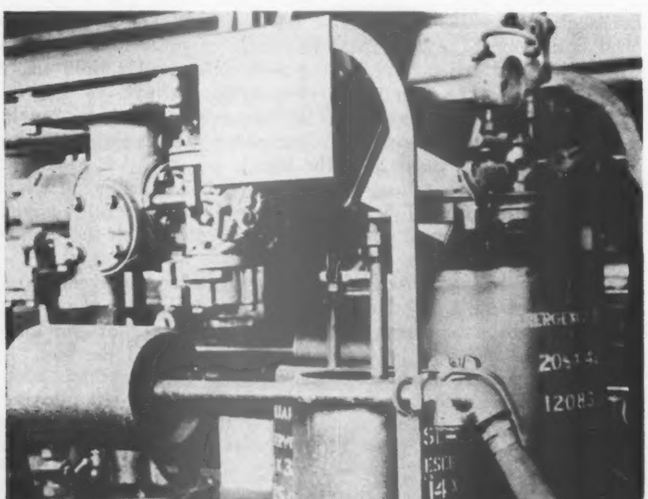
Wheels with worn flange—Usually the wheel with the worn flange is smaller than the mate, probably due to wearing faster on account of softer material. The small wheel crowds the rail and may cause excessive collar friction on both journals.

Passenger-Car Air-Brake Instruction Rack

AIR-BRAKE instruction cars are necessary for giving instructions on air-brake devices and train handling to the various railroad employees whose duty brings them in contact with the operation and handling of these devices. However, it is impossible to devote sufficient time to passenger-car air-brake men to permit them to make tests themselves while attending lectures.

The portable test rack, shown in the illustration, was devised for the purpose of having the air-brake men, including the supervisors, demonstrate the manner in which tests are made by them. When it is found that they are not thoroughly familiar with the instructions they are carefully instructed by a competent air-brake supervisor, and then permitted to make a further demonstration on the rack.

It is constructed from 3½-in., by 3½-in. angles welded together to which are attached an emergency, service and an auxiliary air reservoir. Sufficient area is provided in the application of small reservoirs and air-brake pipe to represent the same area of pipe as is standard on a passenger car. A complete universal valve is attached and coupled in the same manner as it is on a car with the brake cylinder. Two angle cocks and air hose are provided and a single car testing device is erected over the emergency reservoir in a position as to permit coupling the air hose.



Portable test rack for the instruction of passenger-train service employees

The air-brake man who is to demonstrate his ability to perform the various tests first closes the bleed cocks on the reservoirs, closes the two angle cocks, charges the brake-pipe system and couples the single car-test device in much the same manner as he would do on the actual car. He then begins the regular tests, starting with the brake-pipe leakage test and the others in order.

Occasionally the instructor will create a slight leakage in the piping arrangement by opening a small pet cock to cause the demonstrator to complain of leakage. This however is the only defect that is effected but being detected in the first test it causes the air-brake man to be on the alert for other defects.

After completing the test in a satisfactory manner the air-brake man is given a card which is signed by the instructor and indicates that he is qualified to make air-brake tests of passenger trains. The test rack is then loaded and shipped to another passenger car terminal where an instructor is selected and the men at that point given a similar examination.

Decisions of Arbitration Cases

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Handling Line Refuses to Pay Expense of Joint Inspection

On December 26, 1931, the Wichita Falls & Southern advised the Union Tank Car Company that UTLX car No. 15080 was involved in a derailment on its line and that the car had been taken to its Callfield, Tex., shops for repairs. The Union Tank Car Company advised the railroad that when repairs were completed to forward the car to its plant at Sugar Creek, Mo. It also requested that a defect card be attached to the car to cover any unrepaired defects or wrong repairs, or, in lieu of this, the tank car company would have a joint inspection made with the delivery railroad on arrival of the car at Sugar Creek. The handling line requested the tank car company to have a representative present at its Callfield shop upon completion of repairs to the car, as a defect card would not be issued because there would be no defects existing. The tank car company was agreeable to sending a representative to Callfield to make this joint inspection, provided that the railroad would reimburse the company for the traveling expense of its representative. This the railroad refused to do and, after the repair work on the car had been completed, a joint inspection with an inspector of the Fort Worth & Denver City was made. The repaired car was forwarded to Sugar Creek where a joint inspection was made. The tank car company claimed that it was not required to send a representative to inspect the repairs made and to assume all the expense of making such an inspection. It

contended that it had handled the matter in compliance with the first paragraph of Rule 12 and that a defect card should have been issued by the railroad to cover all wrong repairs to the car. In its statement the owners pointed out that the billing-repair card received from the railroad compared with the joint-inspection certificate, showing the location of the improper repairs to the tank to be similar to the location shown on the billing-repair card. In its statement the Wichita Falls & Southern pointed out that the practice of making an inspection at its shop after a car had been repaired was customary of other tank-car owners. Thus, if any changes were desired, such work could be done while the car was still in the shop. The railroad pointed out that it had not been its practice to pay the expense of the car owner's representative. It contended that as the car owner did not send a representative and that the joint inspection made in the shops of the railroad showed the car to be in good condition, it was not required to furnish a defect card as had been requested by the tank car company.

The Arbitration Committee rendered the following decision April 7, 1932: "The contention of the Union Tank Car Company is sustained."—*Case No. 1698, Union Tank Car Company, vs. Wichita Falls & Southern.*

Emergency Brake Application—Owner Responsible for Damaged Car

Wilson Car Line refrigerator car No. 2491 was badly damaged while being handled in Chicago, Burlington & Quincy train second 74, east of Rome, Iowa, on March 8, 1931. The damage consisted of broken wood center, intermediate, side and end sills; wood side plates, metal center channels, bent draft arms, body bolster, and journal boxes; and a number of miscellaneous repairs to the car body. According to the agreed statement of facts, the circumstances under which the car was damaged were as follows. A train of 75 loaded cars was being handled at a speed of about 25 m.p.h. when the clamp on an air hose gave way on the thirty-first car from the rear end of the train. This caused the air hose to blow off the line, thus causing an emergency application which damaged the W. C. L. car No. 2491. This car was the thirty-seventh car in the train from the head end. The car owners wrote to the railroad on March 10, 1931, requesting that the damaged car be forwarded to the owners at Chicago. The railroad replied to this letter under date of April 2, 1931, stating that the car had been damaged due to an emergency application and the damage was such that the load had to be transferred to another car. This letter also pointed out the fact that the road's master mechanic had not informed the proper authorities as to the extent of the damage to the car and that he had loaded it into a gondola car in order to forward it to Chicago. It was also pointed out in this letter that the damage was due to the poor condition of the longitudinal sills and to an old fracture in the steel center sills, and that the car had buckled down just inside the body bolster, practically demolishing the car body. No other car, the letter stated, was damaged in this train. On April 4, the car owners wrote to the railroad complaining of the manner in which the car had been forwarded and requesting that the road furnish additional information with respect to the circumstances which led to the car being damaged. As the result of this letter the railroad furnished reports from the train conductor and engineman, train master and wrecking master. All of these reports were to the effect that the car had buckled and come down between the trucks. The car owners claimed that the railroad was responsible for the damage to this car, including the cost of unloading from the gondola, because the evidence submitted by the railroad showed that the end of the car had dropped down on the rails. Furthermore, the fact that two journal boxes had been damaged was evidence that the car had been derailed and was therefore subject to the provisions of Rule 32. The owners denied that the car was in bad condition as claimed by the railroad. In its statement they pointed out that the car had received a general overhaul in 1923, at which time new steel channels, center and intermediate sills and end sills were applied, as well as new cast-steel draft arms. It contended that the sills were perfectly sound but were discolored due to the action of salt brine which invariably railroad inspectors, without experience, called sills in this condition decayed. It claimed that there was sufficient evidence of rough usage without this car being derailed and that there were indications that the car was off the track and, in evidence thereof, it submitted four photographs showing the damage done to the end of the car. In its statement the railroad pointed out that this was a 50-ton capacity car having a light weight of 49,800 lb., built February, 1911, with two steel center sills and wood longitudinal sills. The railroad stated that its inspection showed that 80 per cent of the breaks in the steel sills were old. With reference to the physical condition of the car, the railroad pointed out that the weakness of the truss rods was a contributing cause of the car buckling. In reply to the statement of the car owners that the railroad had not returned the wooden ends of the sills and the end sill, the railroad stated that it was not necessary to return splintered wood parts which were of no scrap value. It submitted a statement from its wreck master in which it was pointed out that the body bolster, coupler and end of the car was still on the truck and in place. It was, therefore, impossible for these parts to have been on the ground. Relative to the expense of loading and unloading the damaged car from the gondola car, the railroad offered to bear this expense inasmuch as its master mechanic should have reported the fact that it was necessary to load the damaged car and await authority to do so from the owner in accordance with Interpretation 1, Rule 120. The railroad contended that the proper procedure would have been to handle this case as coming under Rule 120, reporting with a statement as required by Rule 44 and holding the car for the owner's inspection and disposition. It further contended that the car was not damaged in unfair usage and was not subject to any Rule 32 condition. That the failure of the car was due to its light construction and the poor condition of the sills and body-truss rods which were not able to withstand the shock.

The Arbitration Committee rendered the following decision: "The car failed as a result of an emergency application of the air brakes due to a failure of the air-brake hose. There is no evidence of unfair usage within the intent of Rule 32; therefore, the car owner is responsible. Decision 1677 is parallel."—*Case No. 1699, Wilson Car Lines vs. Chicago, Burlington & Quincy.*

Always Blame the Railroad.—On the Gulf, Mobile & Northern, as on other railways, they are accustomed to having the railroad get the blame for a great many things, but a recent occurrence, for which the G. M. & N. got the blame, seems to deserve some sort of prize. It seems that a Mobile business man blamed the railway for making him late for work. Residing in the vicinity of the Government Street station in Mobile, where the railway skirts the residential section, this man told his employer that it was his custom to leave the breakfast table and start for the office as train No. 1 whistled for the station. This normally got him to work on time. But he claimed that the train was 10 min. late the other morning, and consequently, so was he.

In the

Back Shop and Enginehouse

Locomotive-Pipe Clamping

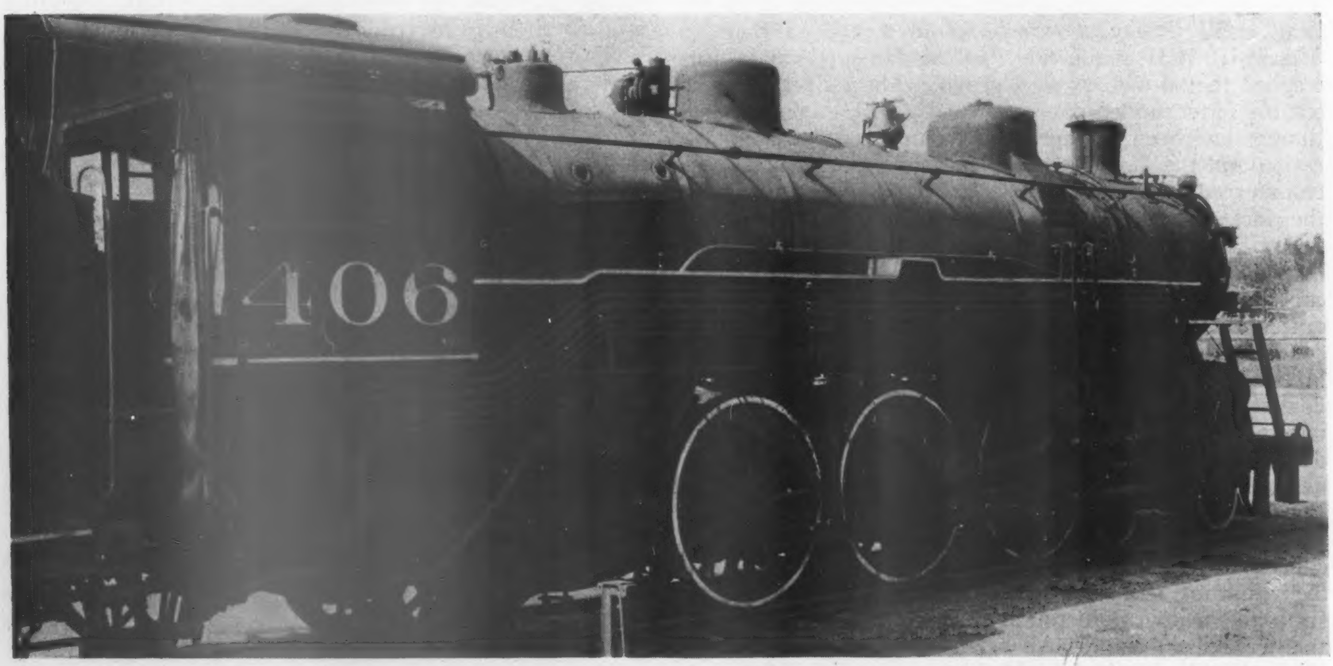
By means of a carefully co-ordinated and intensive effort, the Missouri-Kansas-Texas has in the past four years effected a notable improvement in the clamping of the numerous pipe lines now carried on modern power. In 1928 nine train delays on this road were chargeable to locomotive-pipe failures and, in addition, numerous leaks and pipe defects were repaired by enginemen on the road, not resulting in reportable train delays. The program of improved piping was initiated in 1928 and, in the past two years, there have been no locomotive failures or train delays on the Katy, chargeable to pipe defects on any of the repiped locomotives.

Most of the failures in Katy locomotive piping, as formerly applied, occurred around the distributing-valve, brake-valve and air-reservoir connections, being caused by vibration due to improper and insecure clamping practices, such as, clamping pipes to running boards, using an insufficient number of clamps, using make-shift clamps and multiple clamps which are likely to slip, etc. Short pipe nipples frequently broke and, in many cases, pipes were not threaded far enough into the fittings. For example, two important trains were delayed owing to a failure of the pipe connection to the power-reverse gear. Trouble has been experienced on other roads besides the Katy with locomotive-pipe failures at this point, these troubles being generally charged to vibration, and, in at least one instance, a flexible connection being suggested as the only remedy. Investigation on the Katy developed that the hole in the reverse-gear operating valve was not tapped out large enough to take more than three or four threads of the ¾-inch pipe, and the obvious solution was to tap out the hole large enough to take a full ⅝ in. of thread. In addition, an extra clamp was applied to the air pipe, consisting of a bent angle iron, bolted to the head of the power-reverse gear and provided with a U-clamp in one end, tightly bolted around the pipe to hold it rigid.

How the Improved Pipe-Clamping Method Was Developed

The application of power-reverse gears on all large Pacific-type passenger and main-line freight locomotives afforded an opportunity to revise the main reservoir location and general piping layout including an improved, standardized, pipe-clamping arrangement which would produce the results desired. Realizing the impracticability of developing a satisfactory pipe-clamping arrangement on the drawing board alone, a study was made of locomotives in service to find out which pipes appeared to be subject to excessive vibration and which pipe clamps and clamping methods were most effective in overcoming this vibration. Special consideration was given to clamping methods which expedite the removal and re-application of piping when locomotives are in the shop for general repairs, including, particularly, lagging and jacket removal. As a matter of fact, each class of locomotive was actually piped first and the piping diagram put on the drawing board afterwards.

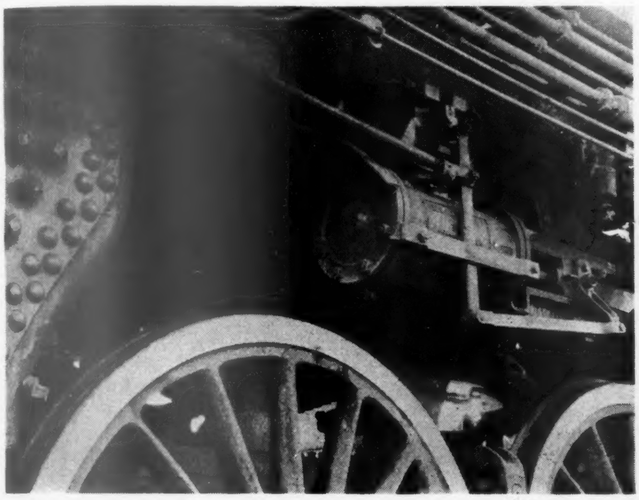
One of the first things discovered was that cab locations varied slightly, even on locomotives of the same class, and it was necessary not only to fix the cab but also the brake valve positions before any real progress could be made in developing a standardized piping layout. In



Pacific type locomotive equipped with the new Katy standardized piping installation

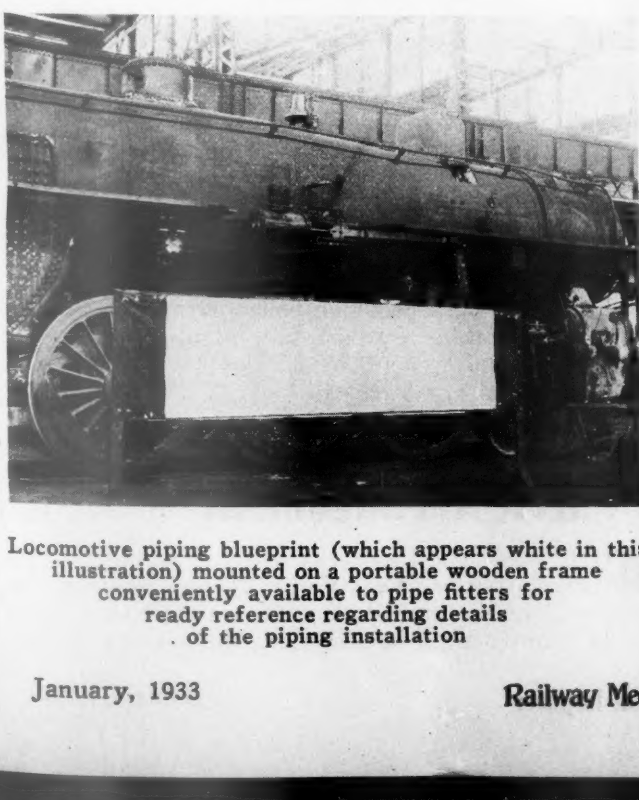
addition, running board brackets were relocated considering the requirements both of the running boards and the pipe clamping.

In general, the clamping method adopted by the Katy calls for pipes supported at intervals not to exceed five feet. Multiple clamps are avoided wherever possible and replaced by individual U-type clamps, rigidly bolted in place. Floating clamps are used to connect all adjacent pipe lines at points where a bracket connection to some rigid part of the locomotive is impractical. All pipe clamps to running boards are avoided in favor of application direct to running-board brackets and other rigid



Angle-iron bracket and U-bolt clamp used in securely supporting ¾-in. air pipe line to the power reverse gear

parts. The piping design is laid out to eliminate all possible joints, with all one-step bushings avoided and replaced by reducing fittings and face-type bushings. Ball joints are specified at reservoir and air-compressor connections where flexibility is shown to be necessary. Instructions have been issued to renew all short nipples at each shopping at places where experience indicates that trouble may be expected, wrought iron nipples being specified at these places subject to failure.



Locomotive piping blueprint (which appears white in this illustration) mounted on a portable wooden frame conveniently available to pipe fitters for ready reference regarding details of the piping installation

With these fundamental principles in mind, standard drawings were prepared to a 1½-in. scale, showing all air brake and other locomotive piping, four general standard piping diagrams covering most of the power now in general use on the Katy.

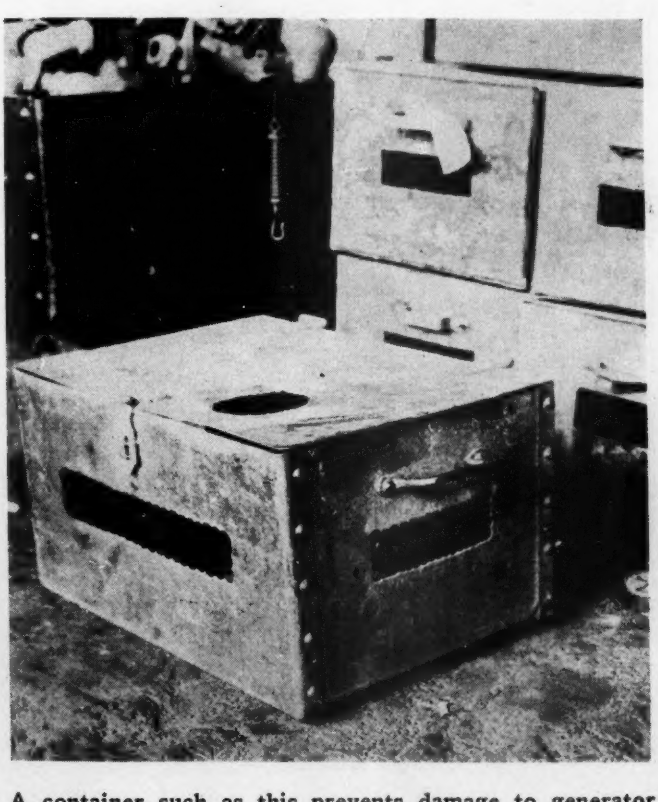
When a locomotive has received heavy repairs in the shop and is ready for the application of piping, a blue print of the standard piping diagram is issued to the shop and mounted on a portable frame conveniently available for the information of the pipe foreman and the pipe gang. When the possibility of standardized piping was first suggested, pipe foremen believed the idea to be impractical. In reality they found that this ready reference to the blue print by pipe fitters relieves the foreman of a large amount of detail in deciding where joints, bends, clamps and other parts shall be located. Previous cut-and-try methods are eliminated by the new arrangement. Pipes are cut in advance. A generally improved quality of pipe-fitting is assured by careful supervision and the issuance of detailed clamp drawings (to supplement the large standard drawings), standard practice cards and manufacturer's instructions for bending and threading.

The success of the Katy in establishing a practicable standard locomotive piping layout is indicated by the fact that, on repiped locomotives, it is no longer possible even for veteran pipe-foremen to tell by the looks of the piping at which shop any particular locomotive was overhauled last.

Container for Generator Sets

To prevent damage to head-light generator sets which are shipped to repair shops for repairs, the metal containers as shown in the illustration will be found useful.

The containers are made from a single sheet of ⅛ in.,



A container such as this prevents damage to generator sets while in transit

sheet steel which is cut out at each corner to permit bending upward and forming the box. The front and back is flanged in order to rivet to the sides, each flange being secured by five ½-in. rivets.

The lid is made from slightly heavier material, ⅜-in., or ¼-in., sheet steel preferred. Ordinary strap hinges and a hasp and staple are welded to the lid and can be attached to the container in the same manner or by riveting. The weight of the container can be materially reduced by cutting out portions of the sides and ends as shown.

Handles provided on each side of the container make them less difficult to handle, in fact when the generator sets are shipped in this manner they are much more easily handled notwithstanding the added weight of the containers.

Inspecting Links, Hooks And Clevises for Flaws

PERIODICAL inspections should be made of hooks, links and clevises that are used in connection with lifting of heavy materials, cars or locomotives. Many accidents have resulted due to these parts failing while in service and in some cases it has developed that an old flaw existed which could have been easily detected had a minute inspection been made of the part. A flaw in a large clevice, which was being used on a wrecking crane by an eastern railroad was responsible for its failure. The locomotive, which was being raised, was damaged considerably when it fell, but fortunately none of the employes who were in the vicinity were injured.

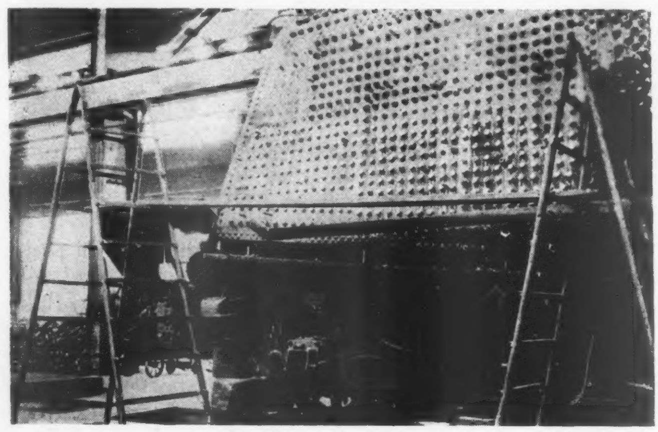
This accident prompted an investigation. It was found that in order to have the tool car on the wrecking train present a clean and orderly appearance, clevices, hooks, links and other emergency parts had to be painted regularly, especially after they had been used. Flaws or fractures in the metal, even though they approached the surface were not visible after the part had once been painted.

It was therefore decided to anneal each part by placing them in a furnace, burning off all paint and allowing them to cool. Each part was then whitewashed and after it became dry was carefully inspected for defects. A surprising number of defective hooks were discovered as well as a few flaws or fractures in links, clevices and steel pins used in the ends of cable.

Clevises and hooks are annealed, whitewashed and inspected after being in service

Portable Scaffolds For the Boiler Shop

THE portable scaffold shown in the illustration is composed of two 11-ft. double ladders through which a scaffold board has been placed to provide a suitable support for the boilermakers and other mechanics whose duties require them to work on the outside of the locomotive.



These scaffold supports are made from used boiler flues

The ladders are constructed from old flues. Four flues being used in each ladder, the ends of which have been flattened and an ordinary strap hinge riveted or welded to form the top. Treads are made from 1½-in. by 1½-in., angles being cut about 30 in. in length, which is an excellent ladder width. The treads can be either riveted or welded to the ladder stile. A ½-in. chain should be attached to the insides of the fourth ladder tread to permit the ladder being opened only so far.

While the scaffold in the illustration is shown erected along side of the locomotive boiler during the process of the removal of caps, it can be used to just as good advantage while hanging air pumps and other appurtenances.

Blowpipe Has Convenient Valve Arrangement

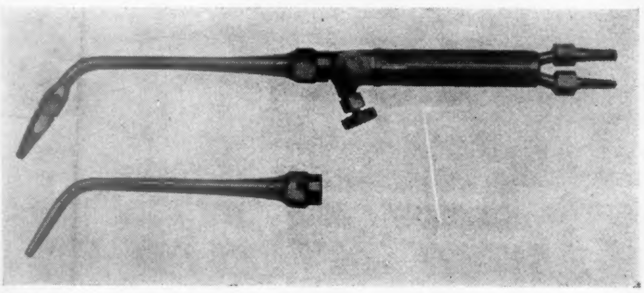
THE Linde Air Products Company, 30 East Forty-Second street, New York, has just announced a new welding blowpipe, designated as the Oxweld Type W-22. Although it has been developed primarily for

use on pipe-line work, its application is not restricted to this field.

The new blowpipe is similar to the Oxweld Type W-17 welding blowpipe except that the oxygen and acetylene valves are located on the front of the handle, so that flame adjustments may be made more readily by the operator while the blowpipe is in operation. Since it is preferable to control flame adjustment by means of the acetylene valve, this valve is located on the left side of the front of the handle where the operator's right thumb can conveniently regulate it.

The oxygen valve is located on the underside of the handle where it may also be easily reached. This arrangement makes it unnecessary for the operator to use his left hand, which is holding the welding rod, to adjust the blowpipe valves.

A special feature of the blowpipe is the long acetylene passageway between the acetylene valve and the injector which minimizes the possibility of flashback. This is accomplished by having three acetylene tubes between the rear and front bodies. Thus, the acetylene comes from the hose connection up to the valve in the front



New Oxweld Type W-22 welding blowpipe, showing both detachable tip and one-piece welding heads

body, passes through a second tube back to the rear body, thence through a cross drilling to a third tube leading to the injector.

The ball-type acetylene valve is another feature of the Type W-22 blowpipe. This type of valve consists essentially of a stainless steel sphere which is hardened and ground with extreme accuracy by a new process. This sphere gives a narrow line of contact and eliminates any difficulties which might be caused by the deposition of carbon in the valves.

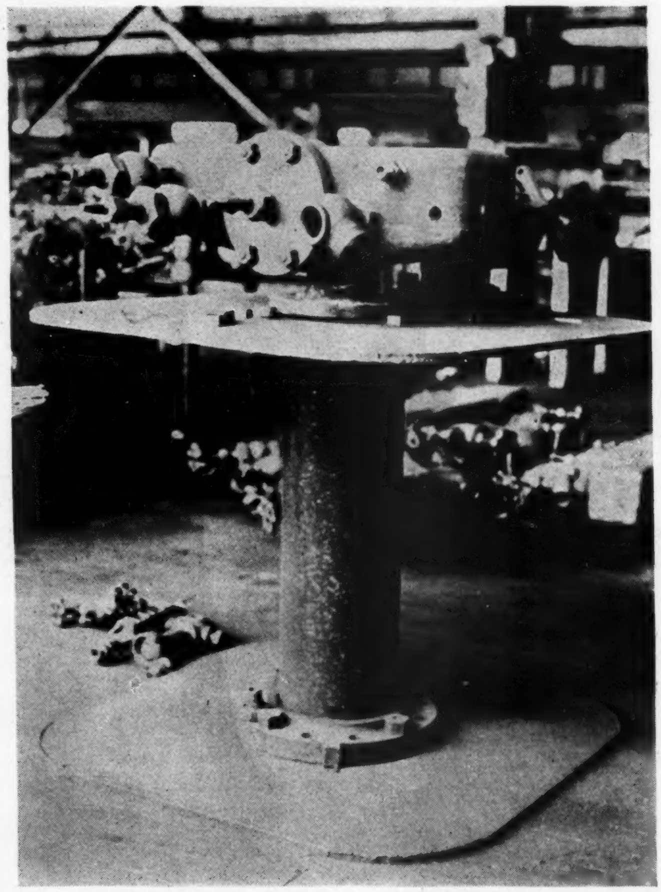
Oxweld Type W-17 welding heads, both one-piece and detachable tip, are used with the Type W-22 blowpipe, and the Oxweld Type CW-17 cutting attachment, the W-17 to W-15 adaptor and extra long Type W-17 welding heads may also be used on the W-22 handle, so that the new blowpipe covers exactly the same range of work as the Oxweld Type W-17 welding blowpipe.

Bench for Repairing Steam Manifolds

WHENEVER locomotives are in back shops for overhauling or are in the enginehouse for removal of flexible caps the steam manifold is usually removed, the main and other steam valves are conditioned and the joints of the manifold are ground in.

The work bench shown in the illustration makes this task somewhat easier for the reason that it revolves and makes it unnecessary to move the manifold after it is once placed.

A piece of boiler plate about five feet in diameter will serve as a base and in the absence of a collar to



Revolving bench for simplifying manifold repairs

screw over the end of a piece of 12-in. pipe, the pipe can be welded to the bottom plate. The top of the pipe should be machined off smooth and the sides smoothed so as to permit an outside collar or sleeve to fit down over it for a distance of six inches. This sleeve can be either riveted, bolted or welded to the top plate. The top plate is made from a piece of ½-in. boiler plate and is four-feet square with the corners rounded.

Holes can be drilled through the top plate for the application of bolts to hold the manifold in position if desired, however the weight of the manifold makes this unnecessary unless the valves are unusually difficult to remove.

The height of the revolving bench is optional, however if it does not exceed 30 in. it will be found best adapted to use for the above purpose.

Efficient Oxyacetylene Cutting Machine Installed

THE illustration shows a modern oxyacetylene cutting machine, as installed in a new building which provides unusually good lighting conditions. The installation includes the necessary furnace and crane facilities for the efficient handling of this important phase of railway repair work.

While the illustration does not show any particular operation, several important ones are suggested. In the foreground is a blacksmith's template for a solid-end main rod. Most of the railroad shops which are equipped with cutting machines make their main and side rods by the oxyacetylene cutting process. The general procedure is to block out the rod under the big steam hammer,

General view of modern oxyacetylene cutting machine in a well-lighted brick and steel shop building

leaving the ends rough and oversize and blocking out the shank square and straight, but only approximately ¼-in. over size to provide stock for machining. After the rod forging has cooled, the ends are laid out and punchmarked, leaving all dimensions ¼ in. over the finish size. These forgings are then placed in a preheating furnace and brought up to a temperature of about 1,200 deg. F. and allowed to soak. The red-hot forging is then placed in position on the cutting-machine work table where the ends are profiled, the torch being guided by a template placed on the cutting machine table.

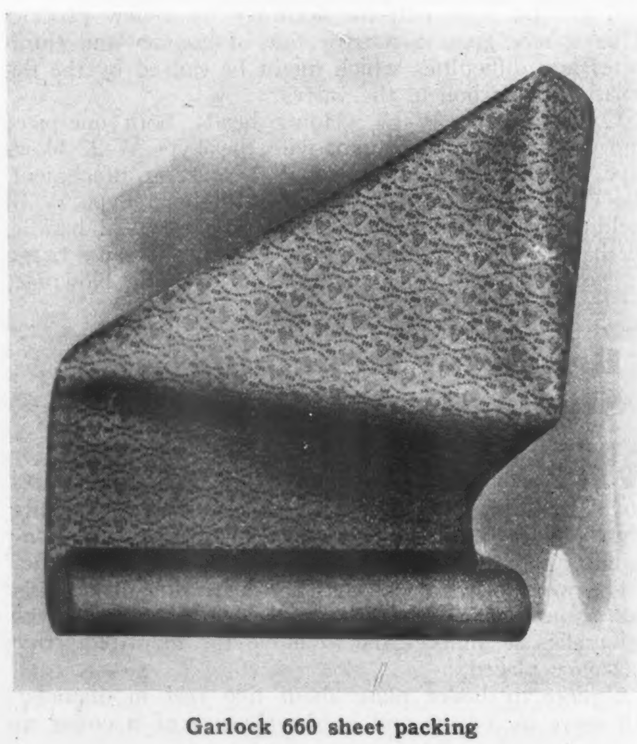
After making both inside and outside cuts on the ends, the rod is ready for the finish machine cuts. This method of making rods shows a substantial economy over the old practice of completely machining the rought forgings. The time and cost of forging is substantially reduced, due to the fact that the blacksmith does not have to work to close limits on the rod ends while the final machining operations are reduced to a simple finishing cut which is considered desirable to remove any possible heat effect resulting from the cutting operation. The actual heat effect produced by the cutting torch does not penetrate the steel to a distance of more than .02 in. or .03 in., so that a light finishing cut removes any metal in which there might be any small heat cracks.

The pile of bar iron under the rod template in the illustration suggests a number of operations for which the cutting machine is effectively used. From stock similar to this, brake levers and equalizers of all kinds are cut at a cost substantially lower than is entailed in the manufacture of similar parts by methods previously employed.

It is interesting to note that the roof trusses in this building, as can be seen in the illustration, were fabricated by welding.

Sheet Packing for Gasoline and Oils

THE Garlock Packing Company, Palmyra, N. Y., recently placed on the market a new type of sheet packing, known as its 660, for gasoline, oil and water



Garlock 660 sheet packing

which is produced by a process that combines granulated cork with tough paper fibre into a gasket material. A patent has been applied for.

The cork particles contained in this packing are said to give exceptional resiliency and softness; the paper fibre adds the durability and toughness necessary for packing service and a liquid-proof compound binds together the two materials.

This packing is soft enough to seal flanges or joints which may be imperfectly machined or in poor condition and it is tough enough to permit its use in paper thicknesses on installations requiring thin gaskets. It is claimed that it will not shrink, curl, crack or become brittle in stock.

Garlock 660 is manufactured in all standard thicknesses from .010 in. to ½ in. In thicknesses less than ⅛ in. it can be supplied in rolls 36 in. wide or in sheets. In ⅛ in. and greater thicknesses it is furnished in sheets 36 in. square. Gaskets cut to specification from Garlock 660 are styled Garlock 661.

Catch-All for Bolts and Nuts

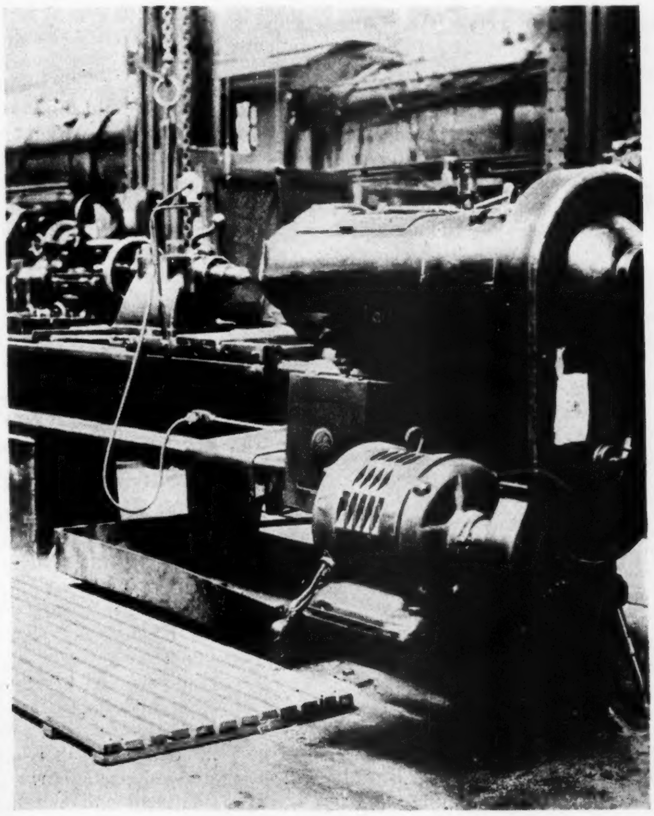
EVERY shop needs a handy catch-all rack for small bolts, nuts, etc. The one shown in the illustration is easily built from small metal baking pans. These are joined, five in a group, by bolting or welding the sides

A convenient rack for the shop storage of bolts and nuts

together near each end. Two groups are then joined. end to end, in the same way. A small strap is applied to the outer ends of each double group by welding or bolting and each group is then bolted to the inside of four uprights of 1½-in. by 1½-in. angles. These angles are bent and forged a few inches from the top so that a single group of five pans just fits at the top end.

Safe Platforms for Machine Operators

IN the majority of cases the floors of machine shops are of concrete construction and when wet provide an excellent ground for the operator should he come in contact with the motor of the machine or a wire from either the electric light of the motor. There are also



Platform designed to minimize the danger from electric shock

more or less of an accumulation of borings or metallic chips from the lathe or drill press that drop to the floor and are likely to cause foot injuries to the operators of the machines.

The illustration shows a portable platform which has been provided for the machine operators on one of the larger railroads and which has prevented many accidents which formerly occurred from the above causes.

The platforms should be of sufficient size to provide access to all parts of the machine by the operator. They can be constructed from ¼-in. by 1½-in. strips of lightweight wood with cross strips of the same dimensions to prevent sagging. The platforms can be raised when cleaning the floor or the particles of dirt can be washed out easily if the cleaning is performed with a hose.

LOCOMOTIVE LARCENY CONTINUES.—Pretty soon the jails are going to be full of railroad enthusiasts who give way to the urge to steal a locomotive. Down at Fairview, Okla., the population of the local hoosegow was increased by one a few days ago, when a Cheyenne Indian from the nearby reservation was removed from circulation on a charge of stealing a Santa Fe engine. The Indian found the locomotive in front of the enginehouse at 1 a. m. and, climbing into the cab, he opened the throttle and headed north. The enginehouse foreman and the town marshal chased the engine by automobile to Orienta, seven miles away, where, after being fired upon, the Indian finally brought the locomotive to a stop.

Among the Clubs and Associations

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—The new A. R. A. rules were discussed at the meeting of the Indianapolis Car Inspection Association held on January 9 at the Hotel Severin, Indianapolis, Ind.

RAILWAY CAR MAN'S CLUB OF PEORIA & PEKIN.—The subject for discussion at the Railway Car Man's Club of Peoria & Pekin to be held at the Union Depot, Peoria, Ill., at 6.45 p.m. on January 20 will be changes in the interchange rules.

RAILWAY CLUB OF PITTSBURGH.—Thomas R. Cook, manager, Inspection and Field Service, The Baldwin Locomotive Works, Philadelphia, will present a paper on The Relation of Locomotive Operation to Operating Income before the meeting of the Railway Club of Pittsburgh at 8 p. m. on January 26 at the Fort Pitt Hotel, Pittsburgh. Stereopticon pictures will be used to illustrate the paper.

TORONTO RAILWAY CLUB.—"The Case of the Railroads Versus Other Means of Transportation" was the title of the paper presented by M. J. Gormley, executive vice-president of the American Railroad Association, before the meeting of the Toronto Railway Club on January 6 at the Royal York Hotel, Toronto, Ont.

CENTRAL RAILWAY CLUB OF BUFFALO.—The forty-four annual dinner of the Central Railway Club of Buffalo will be held on Thursday evening, January 12, at 7 p.m. at the Hotel Statler, Buffalo. J. M. Fitzgerald, vice-chairman of the Committee on Public Relations of the Eastern Railroads, will speak on the St. Lawrence Waterways—"Who Will Pay?" Officers for 1933 will be installed at the Executive Committee meeting at 1.30 in the afternoon.

NEW YORK RAILROAD.—More than 1750 members and guests of the New York Railroad Club attended its annual dinner and sixtieth anniversary celebration at the Commodore Hotel, New York, on December 15. H. H. Vreeland, director of welfare, Interboro Rapid Transit Company, was master of ceremonies and the program included brief talks by the President of the Club—George LeBoutillier, vice-president of the Pennsylvania, — and Mayor-Elect John P. O'Brien of New York. Among the entertainment features were numbers by the New Haven Railroad Glee Club.

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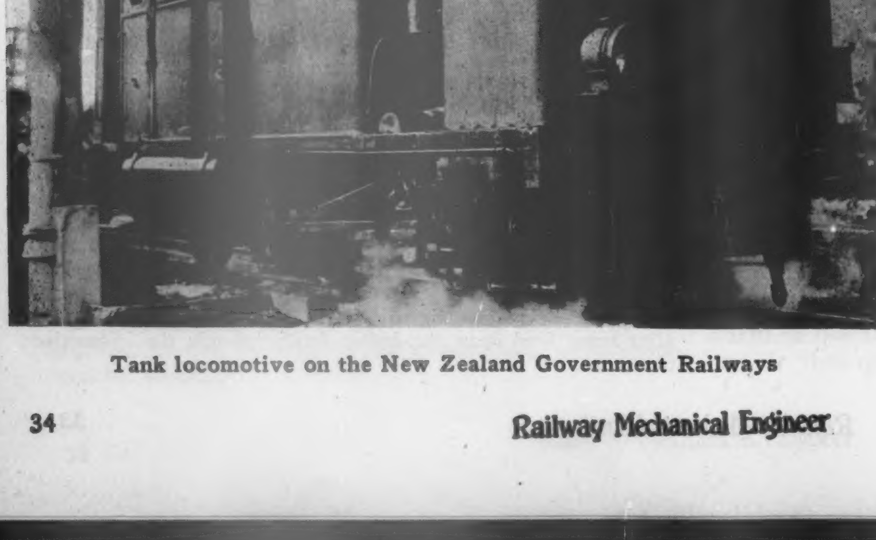

Tank locomotive on the New Zealand Government Railways

Club Papers

Safe Handling of Tank Cars

Chicago Car Foremen's Association.—Meeting held Monday evening, December 12, at the Auditorium hotel, Chicago. Subject "Tank Cars," by W. E. Cooper, superintendent tank car department, Bureau of Explosives, New York. ¶The ever-important subject of the safe handling of explosive and inflammable products in tank cars, under the regulations of the Interstate Commerce Commission, were covered in detail in this address. Mr. Cooper stressed particularly the different kinds of treatment and handling methods necessary with the different classes of commodities, maintaining that carelessness or an error in judgment in interpreting the regulations may result in serious explosions, wrecks, fires, and attendant losses. In order to assure safe transportation of these hazardous commodities, Mr. Cooper also urged car foremen and inspectors to use particular care in seeing that all tank cars loaded with these materials are properly placarded in accordance with the regulations.

"A Century of Progress"

Western Railway Club.—Meeting held Monday evening, December 12, at the Hotel Sherman, Chicago. Speaker Rufus C. Dawes, president "A Century of Progress." ¶This meeting of the club was the annual social gathering of the year, attended by club members and guests, including ladies, and featured by a dinner and a dance in the Bal Tabarin room of the hotel. After some brief entertainment features, President O. E. Ward, superintendent of motive power, Chicago, Burlington & Quincy, Lines East, presented Ralph Budd, president of the Burlington, who introduced the speaker of the evening. In the course of an interesting address outlining the principal features of the "Century of Progress," Mr. Dawes said that this world's fair, to be held in Chicago, will open June 1, 1933, as announced; that the fair is solvent; and that it will prove an effort of which Chicago and the country may well be proud. He said that this is the first fair to be financed entirely without the assistance of local tax-payers. Arrangements have been made for the United States government, as well as most of the states and 14 foreign governments, to participate in the exposition. In the Transportation building, said to have the largest unsupported roof area of any building in the world, 20 railroads will be represented with individual exhibits. In addition, a large part of the Baltimore & Ohio centennial pageant will be conducted in costume, out-of-doors. For purposes of comparison with American practices, the "Royal Scott," crack train of England, will be on display at the exposition.

Draft Gear Maintenance

Northwest Car Men's Association.—Meeting held in the Y. M. C. A. building, Minnesota Transfer, St. Paul, Minn., Monday evening, November 7. Subject "Inspection and Maintenance of Draft Gears and Repair Track Operations," by P. P. Barthelemy, assistant master car builder, Great Northern, St. Paul. ¶After an extensive discussion of the fundamentals of draft-gear performance to meet railway requirements, Mr. Barthelemy said: "The draft gear is one of the most important parts of the modern car, yet, generally speaking, it receives the least attention after once being installed. Its working parts are pretty well concealed and the average inspector or rip track foreman

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'guesses it is all right' if there is no pronounced external indication to show it to be otherwise. The only wonder is that we do not have many times the draft gear trouble, as well as damaged cars and lading, we do have, due to neglecting the proper conditioning of these important and expensive mechanical devices. ¶"All car owners should adopt the practice of making a periodic inspection of draft gears. This inspection should be thorough. The draft gear should be dropped, carefully inspected, and necessary repairs made. At the same time, couplers and yokes should receive like attention, making a critical inspection of yokes in particular for small cracks that may be developing. It is also a good practice to normalize the yokes in a good annealing oven at given periods, the annealing date to be stenciled in the yoke with steel stencils, for future guidance. The follower should be inspected for cracks, wear and distortion. ¶"With the coupler and draft gear down, draft members and other parts are open to free inspection. Particular attention must be given to draft lug rivets. If these are loose, they should be cut out and new ones driven. The practice of heating loose draft rivets with a torch and trying to tighten by driving is bad practice, as, for obvious reasons, the rivets will again be loose in a short time. This is also generally true where some of the rivets in a lug are sheared or loose and are renewed without renewing all the rivets in that stop. After all proper repairs have been made, a stencil should be applied, preferably to draft members near the end of the car, showing the date of overhauling. ¶"Such a program intelligently carried out would greatly reduce draft-gear maintenance costs, as well as those of couplers and yokes, and, keeping these devices up to a much higher service standard will save costly failures and reduce car maintenance costs and claim costs."

Pacific Railway Club Discusses Fuel Conservation

Pacific Railway Club—November meeting held at the Transportation Club, Palace hotel, San Francisco, Cal. Subject "Fuel Conservation." Speakers E. G. Sanders, fuel conservation engineer, Atchison, Topeka & Santa Fe, Topeka, Kan., and R. S. Twogood, assistant engineer, Southern Pacific, San Francisco. ¶Mr. Sanders was the first speaker and, after outlining the importance of fuel conservation to railway men in all ranks of the service, he enumerated briefly the fundamental factors in fuel economy and made the following comment regard engine-crew performance: "It would be proper to comment briefly on the variation in the fuel performance of individual engine crews. It is almost universally true on any division that some engine crews will burn as much as 20 per cent more fuel than other crews handling the same trains and under the same conditions. This statement can be borne out by road foremen and fuel supervisors. The reason for this is, of course, a combination of circumstances. Usually the fireman is careless and does not produce the maximum amount of steam possible from each pound of oil fired and the engineman does not get the maximum power out of the steam delivered at the throttle. Summing up briefly the duties of the engine crew, it is the duty of the fireman to produce the maximum pounds of steam per pound of oil fired as is possible and if he does that and does not waste any steam through pops or blowers, he has done all he can to save fuel and his good fuel record can be spoiled by an engineman who does not use the steam economically. The duty of the engineman is to take the steam produced and deliver the maximum horsepower at the drawbar with the minimum amount of steam and if he does this he has done all he can to save fuel and likewise his fuel record can be spoiled by a fireman who has a low evaporation ratio." ¶Mr. Sanders emphasized the fact that the difference in performance of individual engine crews is not so much a matter of lack of interest in saving fuel as lack of information regarding proper firing and engine handling, it being the responsibility of fuel supervisors and road foremen to work with, and properly instruct, the engine crews who consistently burn the most fuel. ¶The comprehensive and valuable paper presented by Mr. Twogood was on the specific subject "Fuel Conservation, with Special Reference to Cracked Fuel Oil," and emphasized the problems which confront railroads as a result of the more general use of this type of fuel.

Directory

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal Building, New York.

ALLIED RAILWAY SUPPLY ASSOCIATION.—F. W. Venton, Crane Company, Chicago.

AMERICAN RAILWAY ASSOCIATION.—Division V.—MECHANICAL.—V. R. Hawthorne, 59 East Van Buren street, Chicago.

DIVISION V.—EQUIPMENT PAINTING SECTION—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey street, New York.

DIVISION I.—SAFETY SECTION.—J. C. Caviston, 30 Vesey street, New York.

DIVISION VIII.—CAR SERVICE DIVISION.—C. A. Buch, Seventeenth and H streets, Washington, D. C.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth street, New York.

RAILROAD DIVISION.—Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church street

MACHINE SHOP PRACTICE DIVISION.—R. E. W. Harrison, 6373 Beechmont avenue, Mt. Washington, Cincinnati, Ohio.

MATERIALS HANDLING DIVISION.—M. W. Potts, Alvey-Ferguson Company, 1440 Broadway, New York.

OIL AND GAS POWER DIVISION.—Edgar J. Kates, 1350 Broadway, New York.

FUELS DIVISION.—W. G. Christy, Department of Health Regulation, Court House, Jersey City, N. J.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid avenue, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce street, Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 2276 Wilson avenue, Montreal, Que. Regular meetings, second Monday of each month except in June, July and August at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT OFFICERS ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 2514 West Fifty-fifth street, Chicago. Regular meetings, second Monday in each month except June, July and August, Auditorium Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF OMAHA, Council Bluffs and South Omaha Interchange.—Geo. Kriegler, car foreman, Chicago, Burlington & Quincy, Sixteenth avenue and Sixth street, Council Bluffs, Iowa. Regular meetings, second Thursday of each month at Council Bluffs.

CENTRAL RAILWAY CLUB OF BUFFALO.—M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meeting, second Thursday each month, except June, July and August, at Hotel Statler, Buffalo.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 2920 Utopia Place, Hyde Park, Cincinnati. Regular meeting, second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. B. Frericks, 14416 Alder avenue, Cleveland, Ohio. Meeting second Monday each month, except June, July and August, at the Auditorium Hotel, East Sixth and St. Clair avenue, Cleveland.

EASTERN CAR FOREMEN'S ASSOCIATION.—E. L. Brown, care of the Baltimore & Ohio, Staten Island, N. Y. Regular meetings, fourth Friday of each month, except June, July, August and September.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—P. M. Pursian, chief clerk to superintendent of shops. C. C. C. & St. L., Beech Grove, Ind. Regular meetings first Monday of each month, except July, August and September, at Hotel Severin, Indianapolis, at 7 p. m. Noon-day luncheon, 12:15 p. m. for Executive Committee and men interested in the car department.

INTERNATIONAL RAILROAD MASTER BLACKSMITH'S ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark avenue, Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—T. D. Smith, 1660 Old Colony building, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabasha street, Winona, Minn.

MASTER BOILERMAKER'S ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y.

NATIONAL SAFETY COUNCIL—STEAM RAILROAD SECTION.—W. A. Booth, Canadian National, Montreal, Que.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meeting, second Tuesday in each month, excepting June, July, August and September, Hotel Statler, Boston.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Friday in each month, except June, July and August, at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meeting first Monday each month, except June, July and August, at Minnesota Transfer Y. M. C. A. Gymnasium building, St. Paul.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY BUSINESS ASSOCIATION.—P. H. Middleton (Treas. and Asst. Sec.), First National Bank building, Chicago.

RAILWAY CAR MEN'S CLUB OF PEORIA AND PEKIN.—C. L. Roberts, R. F. D. 5, Peoria, Ill.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Ft. Pitt Hotel, Pittsburgh, Pa.

RAILWAY FIRE PROTECTION ASSOCIATION.—R. R. Hackett, Baltimore & Ohio, Baltimore, Md.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1841 Oliver building, Pittsburgh, Pa. Meets with Mechanical Division and Purchases and Stores Division, American Railway Association.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

SUPPLY MEN'S ASSOCIATION.—E. H. Hancock, treasurer, Louisville Varnish Company, Louisville, Ky. Meets with Equipment Painting Section, Mechanical Division American Railway Association.

TORONTO RAILWAY CLUB.—N. A. Walford, district supervisor car service, Canadian National, Toronto, Ont. Meetings first Friday of each month except June, July and August.

TRAVELING ENGINEER'S ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth street, Cleveland, Ohio.

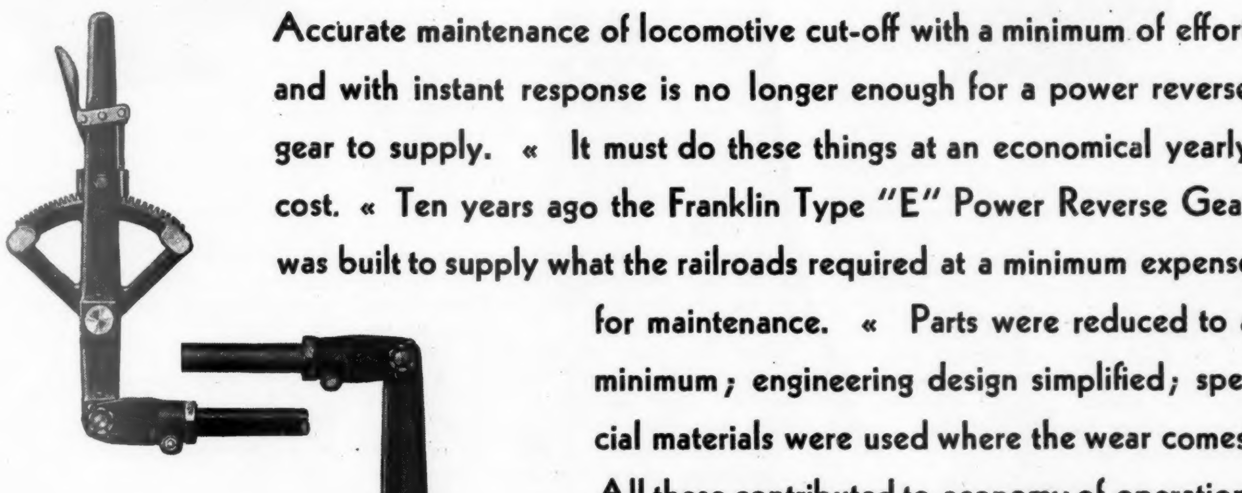
WESTERN RAILWAY CLUB.—J. H. Nash, 1101 Peoples Gas building, Chicago. Regular meetings third Monday in each month except June, July, August and September.

(Turn to next left-hand page)

ACCURATE CUT-OFF CONTROL

. . . at an economical cost!

Accurate maintenance of locomotive cut-off with a minimum of effort and with instant response is no longer enough for a power reverse gear to supply. « It must do these things at an economical yearly cost. « Ten years ago the Franklin Type "E" Power Reverse Gear was built to supply what the railroads required at a minimum expense for maintenance. « Parts were reduced to a minimum; engineering design simplified; special materials were used where the wear comes. All these contributed to economy of operation. « Ten years of operation have thoroughly established the economy of the Type "E" Gear on thousands of locomotives. Specify it for its proved economy.



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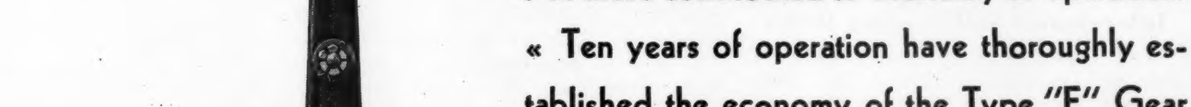
POWER REVERSE GEAR



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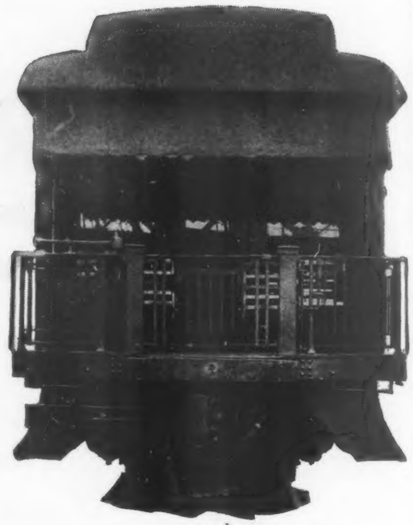
NEWS



The Leipzig Trade Fair will be held on March 5 to 12, 1933, attracting exhibitors and buyers from all parts of the world, as it has for seven centuries. It is expected to be five times the size of any pre-war fair, comprising exhibits from 32 countries and buyers from twice as many lands. Early reports indicate that moderate prices will be the keynote of the Fair which will include over 8,000 exhibits. Detailed information concerning the Fair can be had by addressing the Leipzig Trade Fair, Inc., 10 East Fortieth street, New York.

Interchange and Loading Rules

The Interchange Rules of the Mechanical Division, as revised for 1932, effective January 1, 1933, have been approved by the Board of Directors of the American Railway Association and are ready for distribution.

In order to avoid unnecessary expense, the Loading Rules have not been reprinted. The recommendations contained in the 1932 report of the Committee on Loading Rules and approved at the 1932 annual meeting, and subsequently by letter ballot, have been prepared in the form of a supplement No. 2 to the current Code of Loading Rules, effective January 1, 1933.

Designating Letters for Mechanical Refrigerator Cars

As a result of favorable action on a letter ballot recently submitted to the members of the American Railway Association, Mechanical Division, the following new definitions and designating letters covering mechanical refrigerator cars have been adopted as recommended practice:

"RP" — Mechanical Refrigerator. — A house car equipped with insulation, with or without means of ventilation and provided with some apparatus or other device for furnishing protection against heat and/or cold. Apparatus operated by power generated inside the car (not through the car axle).

"RPA" — Mechanical Refrigerator. — A house car equipped with insulation, with or without means of ventilation and provided with apparatus or other device for furnishing protection against heat and/or cold. Apparatus operated by power derived through the car axle.

P. R. R. Bureau of New Ideas

Five Years' Operation of the Pennsylvania's Bureau of New Ideas have produced more than 10,000 suggestions from employees of that road for improving the service and effecting economies and efficiencies in operation and methods, according to a recent report covering the five year period. Of all the suggestions submitted by employees during this period, 25.4 per cent have been adopted either in whole or in part. During the last three years one out of every three suggestions received was adopted.

Suggestions have come from employees in all departments and from every section of the territory in which the Pennsylvania operates. The number of suggestions received each year remains about constant, but the number adopted has shown a steady increase. For instance, in 1928, out of 2,086 suggestions finally acted upon, 9.2 per cent were adopted; in 1929, out of 2,206 suggestions, 19 per cent were adopted; in 1930, out of 2,584 suggestions, 32.9 per cent were adopted; in 1931, out of 2,120 suggestions, 33.3 per cent were adopted. This year to date, out of 1,246 sugestions finally acted upon, 35 per cent have been adopted.

In addition to money awards and other forms of appropriate recognition for each suggestion adopted, "special" cash prizes have been awarded for each of the best three suggestions adopted during each six months' period.

Railroad Cars Built in 1931

The Bureau of the Census announces that, according to a preliminary tabulation of data collected in the census of manufactures taken in 1932, the value of steam and electric railroad cars built in the United States in 1931 amounted to $48,840,687, a decrease of 80.4 per cent as compared with $249,678,748 reported for 1929, the last preceding census year. Of the 1931 total, $43,086,894 was contributed by establishments engaged primarily in the manufacture, rebuilding, and repair of railroad cars and the remainder, $5,753,793, by railroad repair shops. The total for 1931 was made up as follows: Steam-railroad cars for passenger service (except self-propelled), 193, valued at $5,566,296; steam-railroad cars for freight service, 15,011, valued at $35,010,107; electric railroad cars, 368, valued at $7,158,812; self-propelled cars, $1,105,472 (number not reported). The amount received for repair work plus the value of car parts, as reported by the establishments other than railroad repair shops, aggregated $52,028,863.

The statistics for 1931, with comparative figures for 1929, are given in the following tables.

The figures for 1931 are preliminary and subject to revision.

Table 1.—Summary for the Industry: 1931 and 1929

(The figures in this table do not include data for railroad shops.)

	1931	1929	Per cent of increase (+) or decrease (–)
Number of establishments..	150	147	+2.0
Wage earners (average for the year) [1]..	18,717	40,015	–53.2
Wages [2].......	$25,426,229	$63,387,382	–59.9
Cost of materials, fuel and purchased electric energy [2]	59,723,982	223,889,397	–69.7
Products, total value [2]	99,458,401	328,220,204	–69.7
Railroad cars.	$43,086,894	225,443,507	–80.9
Car parts, value, and receipts for repair work ..	52,028,863	97,267,618	–46.5
Other products (not normally belonging to the industry)	4,342,644	5,508,989	–21.2
Value added by manufacture [3]	39,734,419	104,330,807	–61.9

[1] Not including salaried officers and employees. The average number of wage earners is based on the numbers reported for the several months of the year. In making comparisons the possibility that the proportion of part-time employment was larger in one year than in the other should be taken into account.

[2] Manufacturers' profits can not be calculated from the census figures because no data are collected for certain expense items, such as salaries, interest on investment, rent, depreciation, taxes, insurance, and advertising.

[3] Value of products less cost of materials, fuel, and purchased electric energy.

Flagman Required on Light Locomotives

The Massachusetts State Department of Public Utilities has dismissed the petition of the Boston & Maine asking permission to run light locomotives without a flagman, on those portions of its lines where centralized traffic control is in effect. By an order of the department, all locomotives run without train for a distance of ten miles or more must have one man besides the engineman and fireman. The present order says that the centralized traffic control system must be used a longer time before the department will be warranted in modifying its rule.

Supply Trade Notes

T. J. Crowley has resigned as president and director of the Transportation Equipment Corporation, 230 Park avenue, New York.

The general offices of the Waugh Equipment Company, Depew, N. Y., have been combined with the executive offices at 420 Lexington avenue, New York City.

The Morse Twist Drill & Machine Company, New Bedford, Mass., is now carrying a complete stock of its tools at 570 West Randolph street, Chicago.

Walter Harnischfeger, vice-president of the Harnischfeger Corporation, Milwaukee, Wis., has been elected president and has been succeeded by Donald B. Patterson, general sales manager.

George M. Hunter, operating manager, Pittsburgh district, of the American Bridge Company, has been appointed vice-president in charge of manufacturing operations, with headquarters in the Frick building, Pittsburgh, Pa.

Richard R. Paradies, until recently railway sales representative of the Arco Company, Cleveland, Ohio, has been appointed manager of the railway department of Beckwith Chandler Company, Newark, N. J., manufacturers of paints, varnishes and allied products.

Goulds Pumps, Inc., has acquired the Hydroil Corporation of Lebanon, Ind., manufacturers of oil-purifying apparatus. The Lebanon plant is being discontinued and the business and equipment transferred to the Seneca Falls plant of the Gould Company.

H. Barney Gengenbach, who was for several years connected with the Hale & Kilburn Company, has joined the sales organization of the Heywood-Wakefield Company, Boston, Mass. Mr. Gengenbach will be located at the American Furniture Mart, 666 Lake Shore Drive, Chicago.

John M. Mulholand, until recently vice-president in charge of sales for the O. F. Jordan Company, East Chicago, Ind., has become associated with the Youngstown Sheet & Tube Company, Youngstown, Ohio, as special representative of railroad sales, with headquarters at Chicago.

The United States Steel Corporation will consolidate its warehousing or steel jobbing business, now conducted by the Illinois Scully Steel Warehouse Company, by transferring to it similar operations now conducted by Carnegie Steel Company. The name of the Illinois Scully Steel Warehouse Company will probably be changed to indicate more clearly its relation to the United States Steel Corporation. The change will be effected not later than January 31, 1933. Charles Heggie, now president of Illinois Scully Steel Warehouse Company, will continue as president of the enlarged company.

George E. Doke, formerly president of the Association of Manufacturers of Chilled Car Wheels, has, at his own request, been relieved of active duty and granted an indefinite leave of absence. H. C. Van Buskirk has been appointed executive vice-president in charge of the affairs of the association.

The American Rolling Mill Company, Middletown, Ohio, has acquired the properties of the Lake Erie Steel & Blanking Company, Cleveland, Ohio. M. S. Phillips, assistant to the general manager of sales of The American Rolling Mill Company, has been elected president and general manager of the Lake Erie Steel & Blanking Company.

Curtis G. Green has been appointed district sales manager of the St. Louis, Co., office of the Standard Steel Works Company, Burnham, Pa. Mr. Green has been associated with the Standard Steel Works since 1920 and connected with its St. Louis office since 1929. Prior to that time he was attached to the Houston, Tex., office.

Charles F. Blackmer, vice-president at Cleveland, Ohio, of the American Steel & Wire Company, a subsidiary of the United States Steel Corporation, has succeeded John S. Keefe as president of the American Steel & Wire Company, Mr. Keefe having requested that he be relieved of his duties on January 1. Mr. Blackmer retires under the corporation's pension plan.

George C. McMullen has become associated with the Tyson Roller Bearing Corporation, Massillon, Ohio, as manager of industrial sales. Mr. McMullen was for 15 years with the Timken Roller Bearing Company and had previously been associated in manufacturing and engineering activities with the Timken Detroit Axle Company and the Crane Motor Car Company.

The Bethlehem Steel Company has made a change in its organization as a further step toward a unified sales organization. The department of railway cars and machinery, G. W. Struble in charge, is now a part of the general sales department, reporting to Paul Mackall, vice-president. Mr. Struble, as assistant to vice-president, will continue to be active in the sale of products which he has been handling and in addition thereto will assume further duties assigned to him in the consolidated sales department.

W. E. Crocombe, president of the American Forge Company, has also been elected president of the American Manganese Steel Company, Chicago Heights, Ill., to succeed Wesley G. Nichols, retired.

George M. Bard, chairman of the board of the Barco Manufacturing Company, Chicago, died in that city on December 21.

Arthur B. Johnson, who until May, 1931, was associated with the Standard Steel Car Corporation in its sales department, Pittsburgh district, died on December 18, at Miami, Florida, at the age of 59.

George P. Baldwin, a vice-president of the General Electric Company, died on December 7 at Doctors' Hospital, New York.

Edwin M. Herr, vice-chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, died on December 24 at his home in New York, after an illness of several months. Mr. Herr was born on May 3, 1860, at Lancaster, Pa. He was educated in the public schools at Lancaster and Denver, Colo. About 1876, while still in school, he was employed as messenger and operator by the Western Union Telegraph Company, and then served as telegraph operator on the Kansas Pacific (now a part of the

Edwin M. Herr

Union Pacific) later becoming station agent at Deer Trail, Colo. In 1881, he entered the Sheffield Scientific School of Yale University and was graduated in 1884 with the degree of Ph.B. He later served in the office of the mechanical engineer of the Chicago, Burlington & Quincy at Aurora, Ill., and then as a mechanical draftsman, subsequently becoming successively engineer of tests, superintendent of telegraph and finally division superintendent of that road. In 1891 he was appointed division master mechanic of the Chicago, Milwaukee & St. Paul (now the Chicago, Milwaukee, St. Paul & Pacific) and left that work two years later to go to the Grant Locomotive Works as general superintendent at Chicago. In 1894 he was appointed general manager of the Gibbs Electric Company, Milwaukee, Wis., and on the dissolution of this company shortly thereafter, Mr. Herr went to Europe to

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study foreign railroad practice. On his return to America he re-entered railroad service and in 1895 was appointed assistant superintendent of motive power of the Chicago & North Western; a year later he became superintendent of motive power of the Northern Pacific. Mr. Herr was appointed general manager of the Westinghouse Air Brake Company, at Wilmerding, Pa., in 1898, remaining with that company until 1905 when he was elected first vice-president of the Westinghouse Electric & Manufacturing Company, and when that company entered a receivership in 1907 Mr. Herr served as one of the receivers and general manager. About a year later when the company was reorganized Mr. Herr resumed his former position with the company and in 1911 he was elected president, resigning this position in June, 1929, to become vice-chairman of the board. During his management of the company its business increased from about $20,000,000 annually to approximately $200,000,000 annually. During a visit to Japan in 1920, Mr. Herr was decorated by the Emperor of Japan with the Order of the Rising Sun in acknowledgment of his co-operation in training Japanese students at the works of the Westinghouse Company. Mr. Herr had always been interested in educational matters and devoted much of his time in developing an educational system for employees of the company. He was a member of the Yale (University) Corporation and had served on the committee in charge of finance of that institution. Mr. Herr, in addition to being a member of a number of clubs, was a director of the American Manufacturers' Export Association, Radio Corporation of America, Westinghouse Air Brake Company, Westinghouse Electric & Manufacturing Company.

Frederick P. Huntley, who resigned as vice-president and general manager of the Gould Coupler Company and vice-president of the Gould Storage Battery Company in August, 1917, died at his home in New York City, on December 11. Mr. Huntley began his business career in 1888 as a stenographer to the superintendent of motive power of the New York, Lake Erie & Western, now a part of the Erie. Shortly afterwards he became associated with the Gould interests as a bookkeeper and stenographer in the Gould Steam Forge, Buffalo, N. Y. In 1892 Mr. Huntley was made secretary and director of the Gould Coupler Company, New York, this company having previously absorbed the Gould Steam Forge and in 1900 when the Gould Storage Battery Company was formed, he was elected also vice-president and a director of that company. In 1903 when the plant for the manufacture of large steel castings was erected at Depew, N. Y., in which bolsters, couplers, side frames, and miscellaneous railroad castings were made, Mr. Huntley had direct charge of both the erection of this plant and its operation afterwards. Mr. Huntley resigned as secretary of the Gould Coupler Company in 1905 and was elected vice-president, general manager and a director, which position he relinquished in 1917, also the vice-presidency of the Gould Storage Battery Company.

Personal Mention

General

John Kyle, who has been appointed general superintendent of motive power and car equipment of the Western region of the Canadian National, with headquarters at Winnipeg, Man., as noted in the October issue of the *Railway Mechanical Engineer,* has served in the mechanical departments of several railways in Canada for nearly 40 years. He was born on April 11, 1878, at Toronto, Ont., and after receiving his education in the public and technical schools at Toronto, he entered railway service in 1893, as a mechanical apprentice on the Grand Trunk (now part of the Canadian National). He left this company in 1899 to go with the Canadian Pacific as a machinist at Winnipeg, being appointed leading hand and shop foreman at the Winnipeg enginehouse two years later. In February, 1903, Mr. Kyle entered the service of the Canadian Northern (now part of the Canadian National), as general foreman at Winnipeg, being advanced to assistant master mechanic at that place on October 1, 1907. He was further promoted to master mechanic, with headquarters at Edmonton, Alta., on January 1, 1912, which position he held until March 1, 1923, when he was advanced to superintendent of motive power and car equipment at Edmonton. Mr. Kyle held the latter position until his recent appointment as general superintendent of motive power and car equipment of the Western region.

W. E. Dunkerley, master mechanic of the Pasco division of the Northern Pacific, with headquarters at Pasco, Wash., has been transferred to the Tacoma division, with headquarters at Seattle, Wash., where he replaces J. A. Marshall, who has been appointed assistant master mechanic, with the same headquarters. These changes are coincident with the abolition of the Pasco division and its absorption by the Tacoma and Idaho divisions.

Purchasing & Stores

B. T. Wood, vice-president and chief purchasing officer of the St. Louis-San Francisco, with headquarters at St. Louis, has been given the title of chief purchasing officer under the receiver.

G. M. Betterton, assistant purchasing agent on the Southern Pacific, Pacific Lines, with headquarters at San Francisco, Cal., has been appointed to the newly-created position of purchasing agent with the same headquarters, in which position he will assume the duties of Frank W. Taylor, general purchasing agent of the Pacific Lines, who has retired.

Edgar A. Jones, assistant to vice-president of the Lehigh Valley, has been promoted to purchasing agent, succeeding H. J. McQuade, who has retired because of ill health.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

Lubricants.—"The Importance of Colloidal Graphite Lubricants in Running-In Operations" is the title of bulletin No. 113-3 issued by the Acheson Oildag Company, Port Huron, Mich.

Flex-Arc Welders.—Bulletin No. 16, issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is a 20-page illustrated leaflet describing the features, characteristics and applications of Westinghouse Flex-Arc welders.

Wrought Steel.—A history of Standard "Q.T." (quenched and tempered) wrought steel wheels, their processing and properties, is contained in an illustrated eight-page booklet issued by the Standard Steel Works Company, Burnham, Mifflin Co., Pa.

Mechanical Packing. — "A Practical Handbook of Mechanical Packing" for industrial uses has been issued by the Felt Products Manufacturing Company, 1508 Carroll avenue, Chicago. Samples of the packings of metallic and fibrous materials described accompany the book.

Stainless Steels.—"Stainless Steels and Their Uses" is the title of the booklet issued by the Electro Metallurgical Company, 30 East Forty-Second street, New York. The booklet contains 20 pages and illustrates many applications of stainless steels in various industries, including the railway industry.

Carbex Silicon Carbide Brick.—The General Refractories Company, Philadelphia, Pa., has available bulletins and folders on Carbex silicon carbide brick. The bulletins describe in detail the characteristics of the brick and give illustrations of its application for boiler and industrial furnaces.

Flue Tools.—Ideal flue tools for locomotive boilers; water tube, marine and fire return boilers; condensers, heaters, burners and similar units, and oil refiners are described and illustrated in Catalog No. 57 issued by the Gustav Wiedeke Company, Dayton, Ohio. The locomotive tools are for power or hand use on arch tubes, copper ferrules, feedwater heater tubes, small tubes, superheater tubes, tube setting expaners, etc.

Code of Tests.—Instruction Pamphlet No. 503903, issued by the New York Air Brake Company, New York, is a revised edition of the Code of Tests for Westinghouse and New York Triple Valves on the No. 3-T Test Rack. The pamphlet is of a design similar to previous editions and contains diagrammatic views of the No. 3-T triple valve test rack and piping arrangement. Instruction leaflet No. 2356 gives instructions on the use of condemning gages for Type K triple valves.